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**Stock Assessment and Management  
Advice for the British Columbia  
Herring Fishery: 2009 Assessment and  
2010 Forecasts**

**Évaluation des stocks et conseils de  
gestion pour la pêche au hareng en  
Colombie-Britannique Évaluation de  
2009 et prévisions pour 2010**

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**Abstract**

Herring stock abundance in British Columbia (B.C.) waters was assessed for 2009 and forecasts were made for 2010 using the herring catch-age model (HCAMv2), developed for the 2008 assessment. The B.C. herring fishery is managed as five major and two minor stock areas. Accordingly, catch and survey information is collected independently for each of these seven areas and Science advice is provided on the same scale. All available biological data on total harvest, spawn deposition, and age and size composition of the spawning runs were used to determine current abundance levels. Herring abundance increased coastwide in 2009 in all stock areas except the Prince Rupert District stock. The total estimated pre-fishery biomass for the major assessment regions was 103,470 metric tonnes (t), which represents a 9% increase over the 2008 abundance 95,076 t. The recruitment of the 2006 year class in 2009 was average for the Queen Charlotte Islands and the Central Coast, good for the Strait of Georgia, poor for west coast of Vancouver Island while recruitment in Prince Rupert was poor to average. The stock projections for 2010 indicate reduced abundance and poor recruitment in three major stock areas that will not support commercial harvest: Queen Charlotte Islands, west coast of Vancouver Island, and the Central Coast. Using formal decision rules that consider past stock status and recruitment, the estimated harvestable surplus of B.C. herring in 2010 (20% of the 2010 forecast spawning stock biomass) in the two remaining major areas is 3,100 t in the Prince Rupert area (average recruitment) and 9,000 t in the Strait of Georgia (poor recruitment). Harvest recommendations for the minor stock areas assume average recruitment and follow a precautionary 10% harvest rate: 135 t in Area 27 and 413 t in Area 2W.

## Résumé

L'abondance des stocks de hareng dans les eaux de la Colombie-Britannique a été évaluée pour 2009 et des prévisions ont été faites pour 2010 à l'aide du modèle des prises de hareng selon l'âge (HCAMv2), mis au point pour l'évaluation de 2008. La pêche au hareng en Colombie-Britannique est gérée en fonction de cinq principales zones d'évaluation des stocks et de deux zones secondaires. En conséquence, la collecte de l'information sur les prises et les relevés se fait indépendamment pour chacune des sept zones et les avis scientifiques sont donnés selon le même mode. Toutes les données biologiques disponibles sur les prises totales, la ponte ainsi que la composition selon l'âge et la taille des reproducteurs en migration ont été utilisées pour déterminer les niveaux d'abondance actuels. En 2009, l'abondance du hareng sur l'ensemble de la côte a augmenté dans toutes les zones de stocks sauf pour le stock du district de Prince Rupert. La biomasse totale estimée des harengs avant la pêche dans les principales zones d'évaluation était de 103 470 tonnes métriques (t), soit une augmentation de 9 % par rapport à l'abondance de 95 076 t en 2008. En 2009, on a obtenu un recrutement moyen de la classe d'âge de 2006 dans les îles de la Reine-Charlotte et la région de la côte centrale, tandis qu'il a été bon dans le détroit de Georgie, faible sur la côte ouest de l'île de Vancouver et que le recrutement à Prince Rupert a été de faible à moyen. Les projections relatives aux stocks pour 2010 indiquent une abondance réduite et un recrutement faible qui ne pourra soutenir la pêche commerciale dans trois principales zones d'évaluation, soit celles des îles de la Reine-Charlotte, de la côte ouest de l'île de Vancouver et de la côte centrale. En utilisant les règles de décision qui tiennent compte de la biomasse totale passée et du recrutement passé, l'estimation de l'excédant récoltable de harengs en Colombie-Britannique pour 2010 (20 % de la biomasse prévue du stock reproducteur de 2010), dans les deux autres zones principales, se situe à 3 100 tonnes pour la zone de Prince Rupert (recrutement moyen) et à 9 000 tonnes pour le détroit de Georgie (recrutement faible). Les recommandations concernant la capture dans les zones secondaires supposent un recrutement moyen et adoptent un taux de capture prudent de 10 %, soit de 135 t dans la zone 27 et de 413 t dans la zone 2W.

## Executive summary

The B.C. herring fishery is managed as five major and two minor stock areas. Accordingly, catch and survey information is collected independently for each of these seven areas and science advice is provided on the same scale. The 2009 stock assessment for the B.C. herring fishery was carried out using a version of a herring catch-age model (HCAMv2), developed for the 2008 assessment. Our approach involves fitting this catch-age model to the time series of commercial catch data, spawn index and proportions-at-age data within a Bayesian estimation framework. Model outputs for the time series include estimates of recruitment (3 year old fish), numbers at age, spawning stock biomass and pre-fishery forecasts of biomass, as well as estimates of natural mortality, fishing mortality and fishery selectivity by gear type. Biomass estimates represent median estimates from the marginal posterior distributions. Catch advice, presented in the form of decision tables, is based on model forecasts of repeat spawners and posterior distributions of recruitment under assumptions of poor, average and good recruitment. For the Strait of Georgia and West Coast Vancouver Island stocks, recruitment forecasts are based on results from the summer off-shore trawl survey. For the Queen Charlotte Islands, Prince Rupert District and Central Coast stocks, recruitment forecast rules are applied based on recent stock trends. For the two minor stocks, the recruitment forecast rule is to assume an average recruitment.

This year, two changes were made to the HCAMv2 model. The first relates to the way in which ageing samples are used by the model and the second relates to the way we parameterize initial fishing mortality rate. We discovered that the 2008 configuration of HCAMv2 omits a number of ageing samples from the analysis. Specifically, for a given area, ageing samples were being omitted in years where there is no catch for the roe seine fishery. This omission has been corrected in the 2009 configuration of HCAMv2 and implications of this change are discussed herein. Several points have been identified as outstanding issues in modelling herring stocks, including: understanding the relationship between natural mortality and steepness in recruitment productivity, estimating natural mortality, and applying fishing gear selectivity functions.

### Major stock areas:

#### *Queen Charlotte Islands*

The estimated spawning biomass for 2009 is approximately 7,000 tonnes, a considerable increase from the 2008 estimate of spawning biomass (~5,000 tonnes). Model estimates of recruitment for this stock have alternated between poor and average over the last 10-years, with 2009 estimated as average recruitment. For the Queen Charlotte Islands stock, the recruitment forecast rule denotes poor recruitment, thus the forecast biomass for 2010 is ~5,800 tonnes. This stock is below cutoff. Following the herring harvest control rule, the recommendation is for no commercial harvest in this area.

#### *Prince Rupert District*

The estimated spawning biomass for 2009 is approximately 15,000 tonnes. This is somewhat lower than the 2008 estimate of spawning biomass (~17,000). The 2009 model estimates of recruitment for this stock appear to be on the divide between poor and average. For the Prince Rupert District stock, the recruitment forecast rule denotes average recruitment, thus the forecast biomass for 2010 is ~15,500 tonnes. This stock is above cutoff. Following the herring harvest control rule, the available harvest, based on a 20% harvest rate, is 3,100 tonnes.

#### *Central Coast*

The estimated spawning biomass for 2009 is approximately 10,000 tonnes, a considerable increase from the 2008 estimate of spawning biomass (~6,500 tonnes). Model estimates of recruitment for this stock have alternated between poor and average over the last 10-years, with one good recruitment year in 2003. For the Central Coast stock, the recruitment forecast rule denotes poor recruitment, thus forecast biomass for 2010 is ~7,500 tonnes. This stock is below cutoff. Following the herring harvest control rule, the recommendation is for no commercial harvest in this area.

### *Strait of Georgia*

The estimated spawning biomass for 2009 is approximately 48,000 tonnes, a considerable increase from the 2008 estimate of spawning biomass (~34,000 tonnes). Model estimates of recruitment to this stock have alternated between average and good over the last 10-years, with one poor recruitment year in 2008. Recruitment in 2009 was estimated as good, reflecting predictions provided by the 2008 off-shore recruitment forecast survey. Results from the off-shore survey indicate recruitment for 2010 will be poor, thus the forecast biomass for 2010 is ~45,000 tonnes. This stock is above cutoff. Following the herring harvest control rule, the available harvest, based on a 20% harvest rate, is 9,000 tonnes.

### *West Coast Vancouver Island*

The estimated spawning biomass for 2009 is approximately 5,000 tonnes. This is nearly double the 2008 estimate of spawning biomass (~2,700 tonnes). Model estimates of recruitment for this stock have been poor for the majority of the past 10-years. Recruitment in 2009 was estimated as poor, reflecting predictions provided by the 2008 off-shore recruitment forecast survey. Results from the off-shore survey indicate recruitment for 2010 will be poor, thus the forecast biomass for 2010 is ~6,000 tonnes. This stock is below cutoff. Following the herring harvest control rule, the recommendation is for no commercial harvest in this area.

## **Minor stock areas:**

### *Area 27*

The estimated spawning biomass for 2009 is approximately 1,600 tonnes, up slightly from the 2008 estimate of spawning biomass (~1,400 tonnes). Model estimates of recruitment to this stock were poor in 2008 and good in 2009. For Minor Stock Area 27, the recruitment forecast rule denotes average recruitment, thus the forecast biomass for 2010 is ~1,350 tonnes. The available harvest, based on a 10% harvest rate, is 135 tonnes.

### *Area 2W*

Estimates of spawning biomass were highly influenced by the inclusion of additional ageing samples, thus Minor Stock Area 2W results are presented using both the 2008 and 2009 configurations of the HCAMv2 model. The two estimates of spawning biomass for 2009 are ~2,900 and ~5,700 (A2W-A and A2W-B, respectively) and we conclude that the latter estimate is most representative for providing catch advice. Both model configurations indicate recruitment to this stock was good in 2009. The recruitment forecast rule denotes average recruitment, thus forecast biomass for 2010 is ~4,100 tonnes. The available harvest, based on a 10% harvest rate, is 413 tonnes.



## 1 Introduction

The objectives of this paper are two-fold: (1) to present the 2009 stock assessment advice for the B.C. herring fishery and (2) to provide a detailed description of the current assessment model and decision rules, bringing together model descriptions and equations previously reported in Haist and Schweigert (2006), Schweigert and Haist (2007), Schweigert et al. (2009) and Christensen et al. (2009).

B.C. herring are currently managed as five major and two minor stock areas. Accordingly, catch and survey information is collected independently for each of these seven areas and science advice is provided on the same scale. Since the early 1980's, a statistical catch-age model has been used to provide stock assessment advice for the major stock areas (Haist and Stocker 1984). In 2006 the catch-age model was termed the herring catch age model (HCAM, Haist and Schweigert 2006), used for the 2006 and 2007 stock assessments. A modified version, HCAMv2, was used in the 2008 and the current year's assessments (modifications to HCAM are documented in Christensen et al. 2009). During the 2008 assessment, Schweigert et al. (2009) determined that the time series of survey data for the minor stock areas was sufficiently long enough to implement a catch-age assessment, rather than using the escapement model from past years (Schweigert 2001). Thus, the HCAMv2 model is now implemented for all seven stock areas. However, it should be noted that decision rules for determining the PSARC Science recommended catch differ between major and minor stock areas (see Section 4.7).

## 2 B.C. herring stocks

The geographic boundaries used to delineate the B.C. herring stock assessment regions have remained consistent since 1993. Boundaries and locations of the major stock areas: Queen Charlotte Islands (QCI), Prince Rupert District (PRD), Central Coast (CC), Strait of Georgia (SOG), West Coast Vancouver Island (WCVI) and minor stock areas: Area 2W and Area 27, are identified in Figure 1.

The Queen Charlotte Islands stock assessment region includes most of Statistical Area 2E, spanning from Cumshewa Inlet in the north to Louscoone Inlet in the south. The Prince Rupert District stock assessment region encompasses Statistical Areas 03 to 05. The Central Coast assessment region separates the major migratory stocks from the minor spawning populations in the mainland inlets. The Central Coast assessment region includes Statistical Area 07 plus Kitasu Bay in Area 06, Kwakshua Channel in Section 085 and Fitz Hugh Sound in Section 086. The Strait of Georgia stock assessment region includes all of Statistical Areas 14 to 19, 28, and 29 (excluding Section 293), and Deepwater Bay and Okisollo Channel, both in Section 132. The west coast of Vancouver Island assessment region encompasses Statistical Areas 23 to 25. The minor stocks include all of Area 27 and Area 2W (excluding Louscoone Inlet in Section 006). Current geographic stock boundaries are outlined in Midgley (2003), although note that SOG sections 280 and 291 do not appear as they were added in 2006.



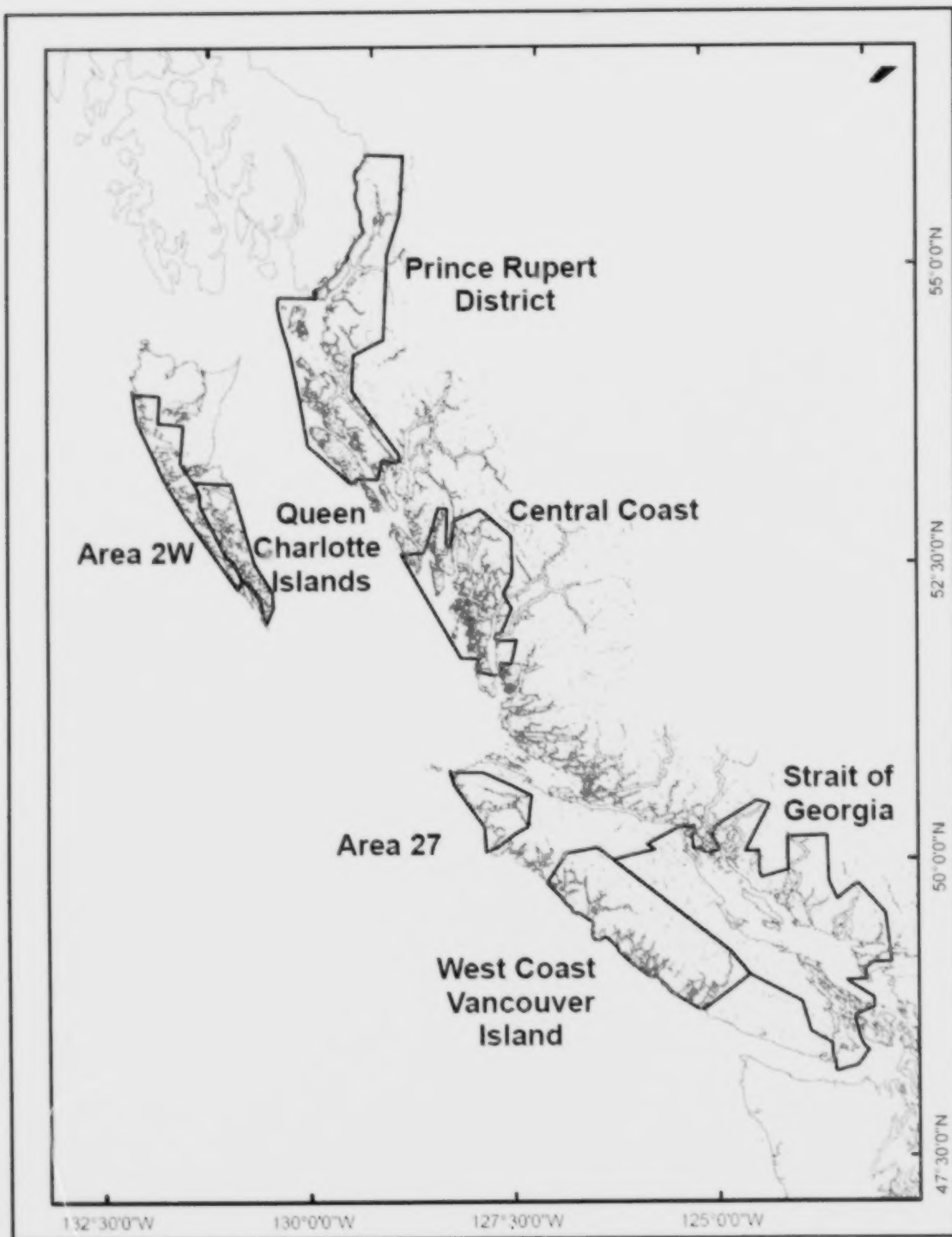


Figure 1. B.C. herring major stock areas: Queen Charlotte Islands (QCI), Prince Rupert District (PRD), Central Coast (CC), Strait of Georgia (SOG), West Coast Vancouver Island (WCVI), and minor stock areas: Area 2W and Area 27.

### 3 Data

The herring assessment model is driven by three sources of data: commercial catch landings, a spawn survey index and age composition data. Each of these time series of data represent the collective efforts of the herring industry, First Nations and DFO Science and FAM. For the purposes of stock assessment, we include fishery and survey data from 1951 onwards. These time series are stored in a MS Access database, referred to as the HSA or herring stock assessment fisheries database. Catch and biological information is also collected from the "minor" herring fisheries (food & bait, special use, spawn-on-kelp) and a database is currently being developed to incorporate these data.

#### 3.1. Commercial catch data

Catch information is obtained from landing slips or monitoring of plant offload data. Historically, landing slip data were summed by fishery season (seasons run from July 1 to June 30). Beginning in the 1997/98 season, roe catch figures are based on verified plant offload weights, a result of the introduction of the individual vessel quota ('pool fishery') system for all fisheries except the Strait of Georgia and Prince Rupert gillnet fisheries which remained open fisheries. Beginning in the 1998/99 season, verified plant offload weights are available for all food and roe fisheries coast-wide.

The history of catches in the major assessment areas appear in Figure 2. Commercial landings from the spawn-on-kelp (SOK) fishery are not included in the model as catch because there is no basis for verifying mortality imposed on the population. Instead, beginning with the 2006 assessment, the validated landed weight of SOK product is used to estimate the egg removal from the spawning grounds and these data are converted to tonnes of fish equivalents based on data provided in Shields et al. (1985). These estimates are then added to the estimated spawning biomass for each area over the course of the SOK fishery from 1975 to present. Landings from the minor herring fisheries (food & bait, special use) are based on landing slip data or more recently logbook information.

The time series of commercial catch data is divided into three periods: fishing period 1 or the winter period, which primarily represents the reduction fishery (1951-1968), fishing period 2 which represents the roe seine fishery (1972-present), and fishing period 3 which represents the roe gillnet fishery (1972-present). The history of catches by fishing period is presented in Figure 3.

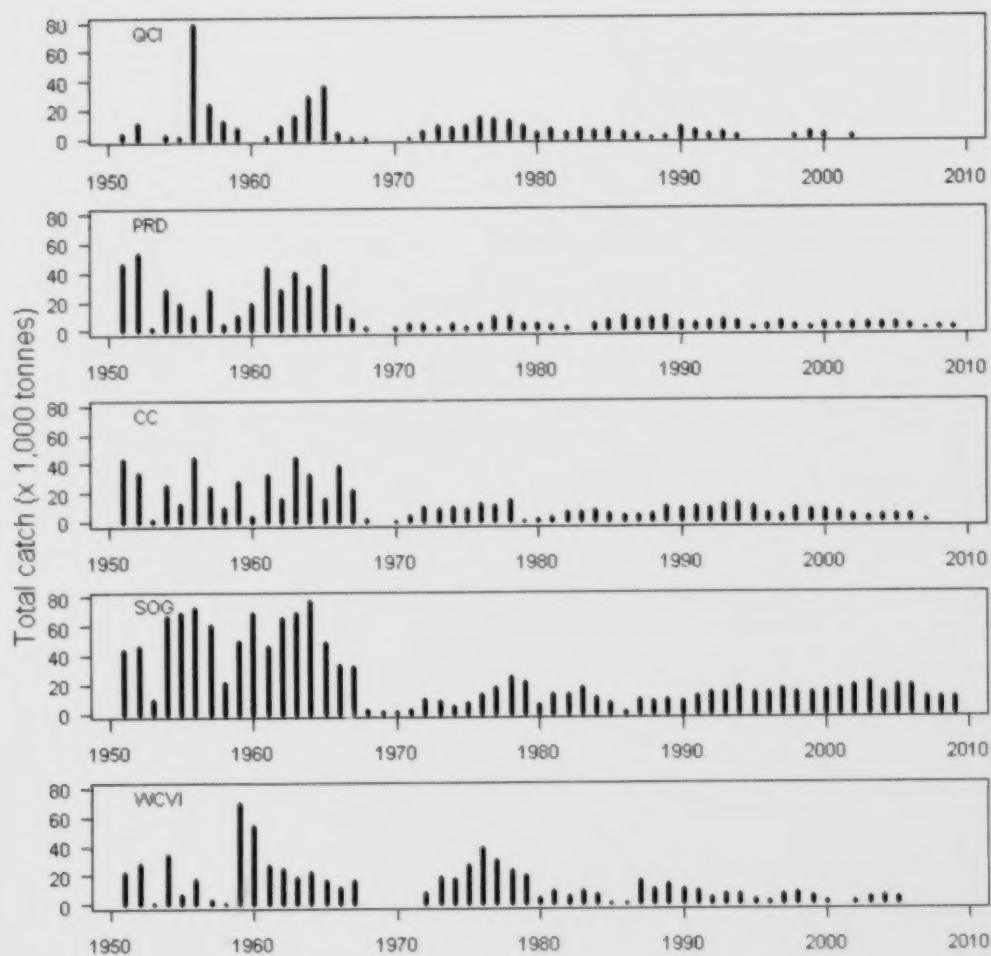


Figure 2. Estimated total catch from all fisheries except spawn-on-kelp for each major stock area from 1951-2009

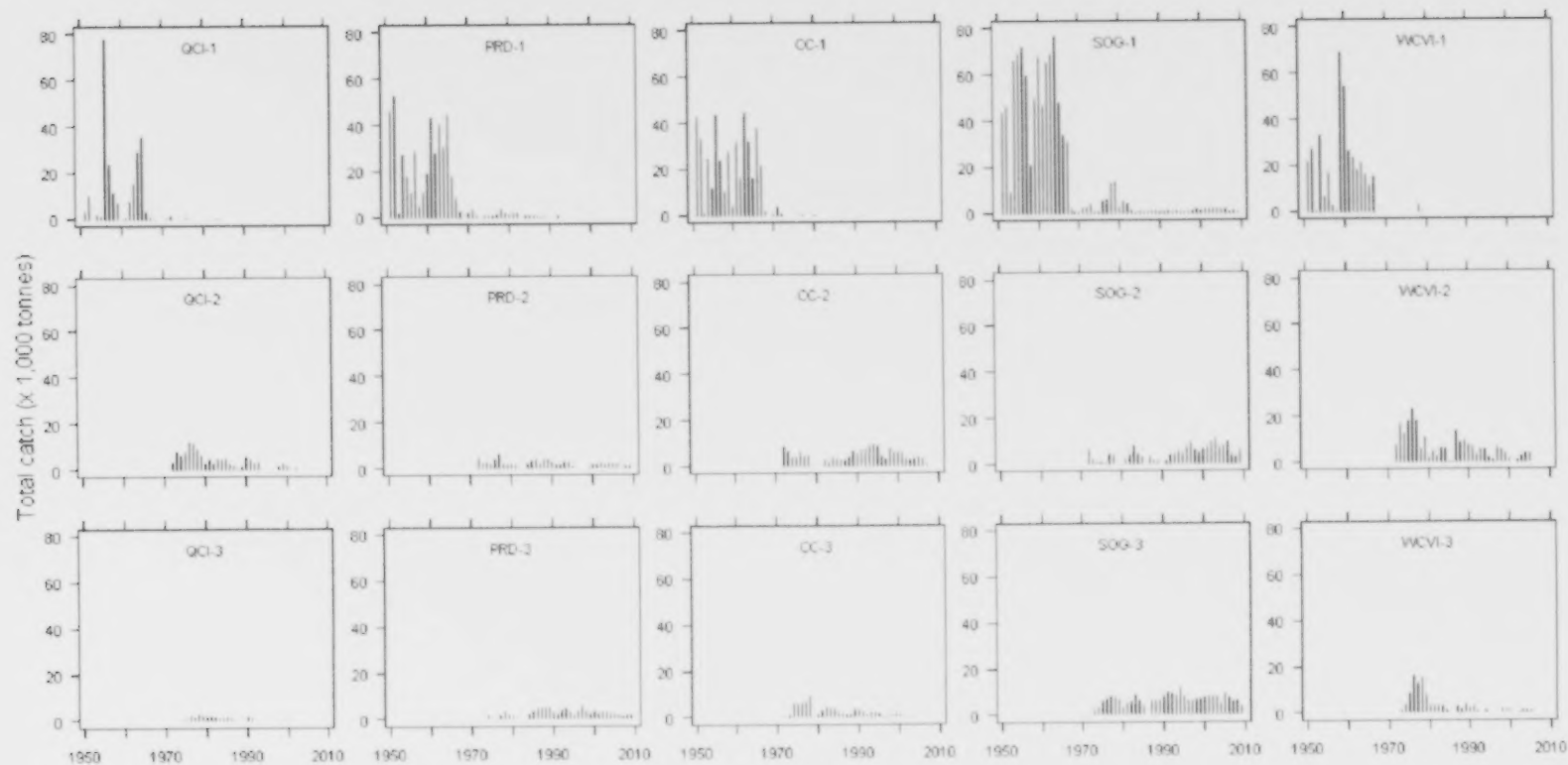


Figure 3. Estimated total catch by fishing period for each major stock area from 1951-2009 (excludes spawn-on-kelp fishery). Upper row- Fishing period 1 – primarily seine and reduction fisheries, except recent years in SOG which represent food and bait/ special use fisheries; Middle row- Fishing period 2 (seine roe fishery); Bottom row- Fishing period 3 (gillnet roe fishery)

### 3.2. Spawn data (survey index)

Herring spawn surveys have been conducted throughout the B.C. coast beginning in the 1930s. In years prior to 1988, spawn surveys were conducted from the surface either by walking the beach at low tide or using a drag from a skiff to estimate the shoreline length and width of spawn. Egg layers were sampled visually and are used to calculate egg densities following the methods of Schweigert (2001). Beginning in 1988, herring spawn surveys using SCUBA methods were introduced and became coastwide within a couple of years initially being conducted by DFO staff but eventually through contract divers hired through the test fishing program. Prior to the Larocque ruling, the test fishing program was funded through an allocation of fish by industry. In years since the 2006 Larocque ruling, the availability of resources to conduct dive surveys in all areas has been reduced. For the 2009 survey, dive surveys were conducted in all major and minor assessment regions, with the exception of Area 2W where snorkeling and surface survey methods were also used. As in earlier years, a few minor spawning beds outside the main assessment areas were surveyed by SCUBA or surface methods where resources permitted.

Figure 4 shows locations of spawning beds in 2009 for the major and minor stock areas. Egg density estimates are used to calculate a fishery-independent estimate of herring spawners (in units of fish biomass), referred to as the spawn survey index (Schweigert 2001). The time series of survey index, from 1951-2009, for each of the major stock areas is shown in Figure 5.

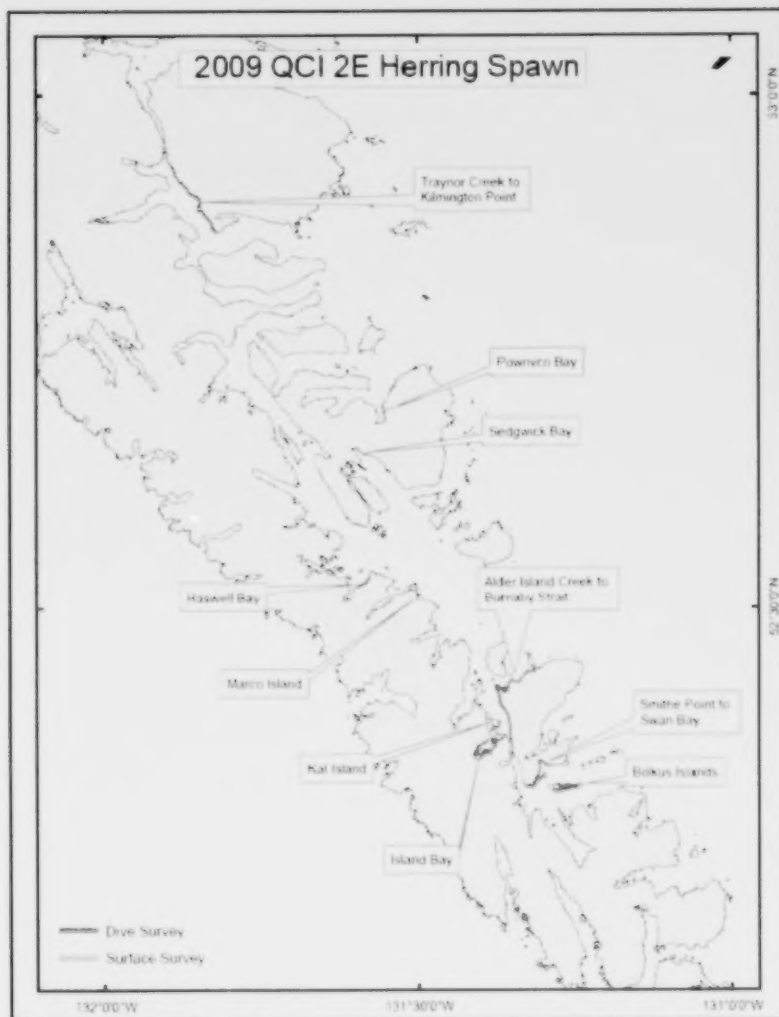


Fig 4. QCI (major stock area)

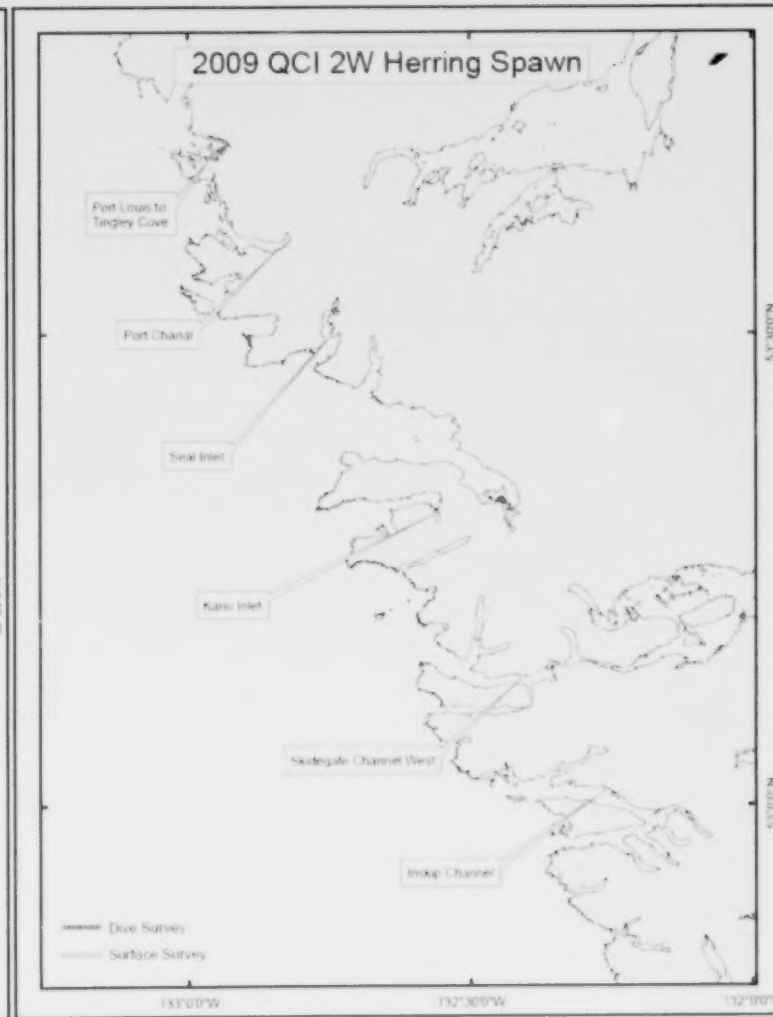


Fig 4. Area 2W (minor stock area)

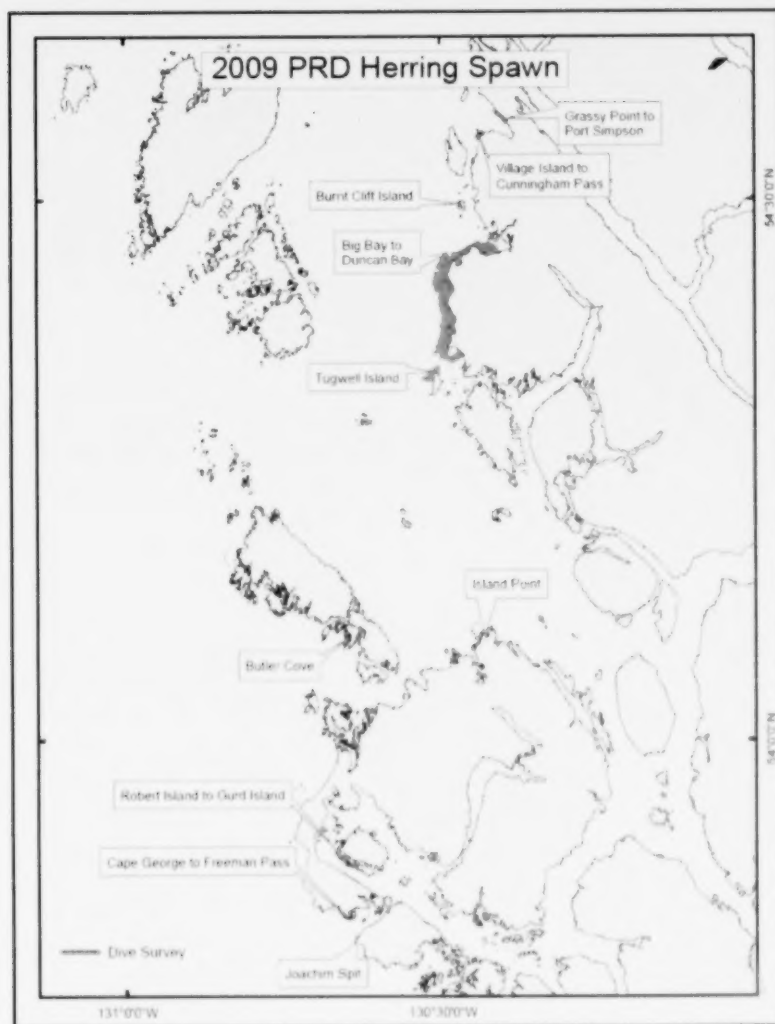


Fig 4. PRD (major stock area)

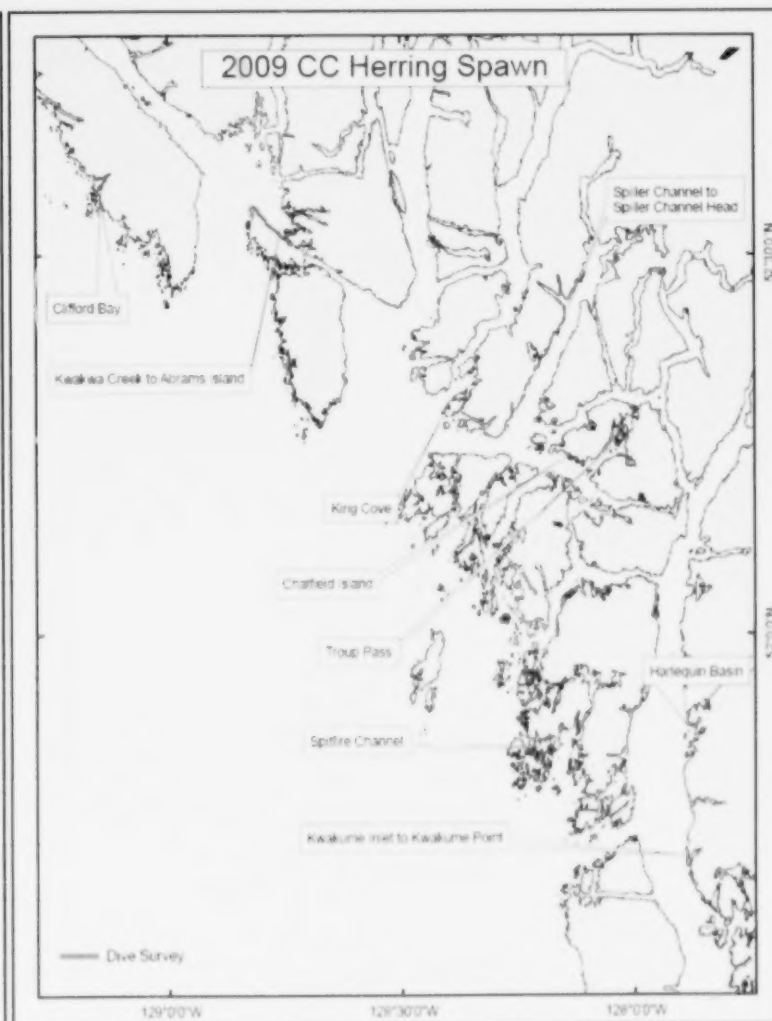


Fig 4. CC (major stock area)



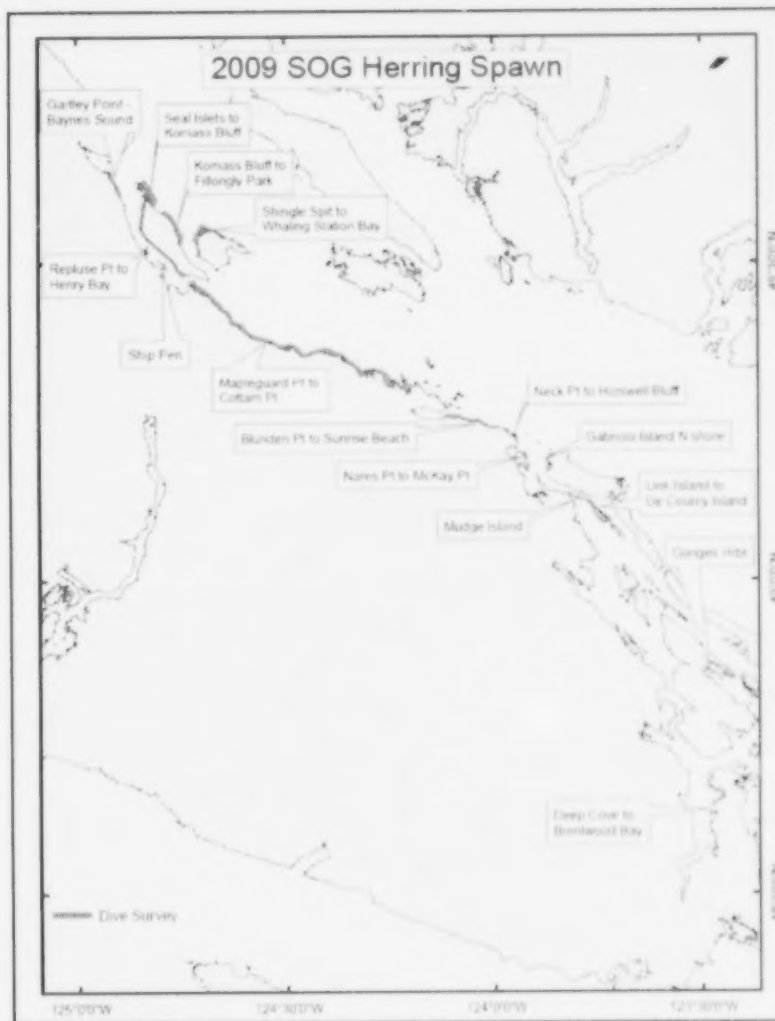


Fig 4. SOG (major stock area)



Fig 4. WCVI (major stock area, includes Area 27)

Figure 4. Herring spawning bed locations for the 2009 survey year. Red lines denote locations surveyed by SCUBA; blue lines denote surface methods

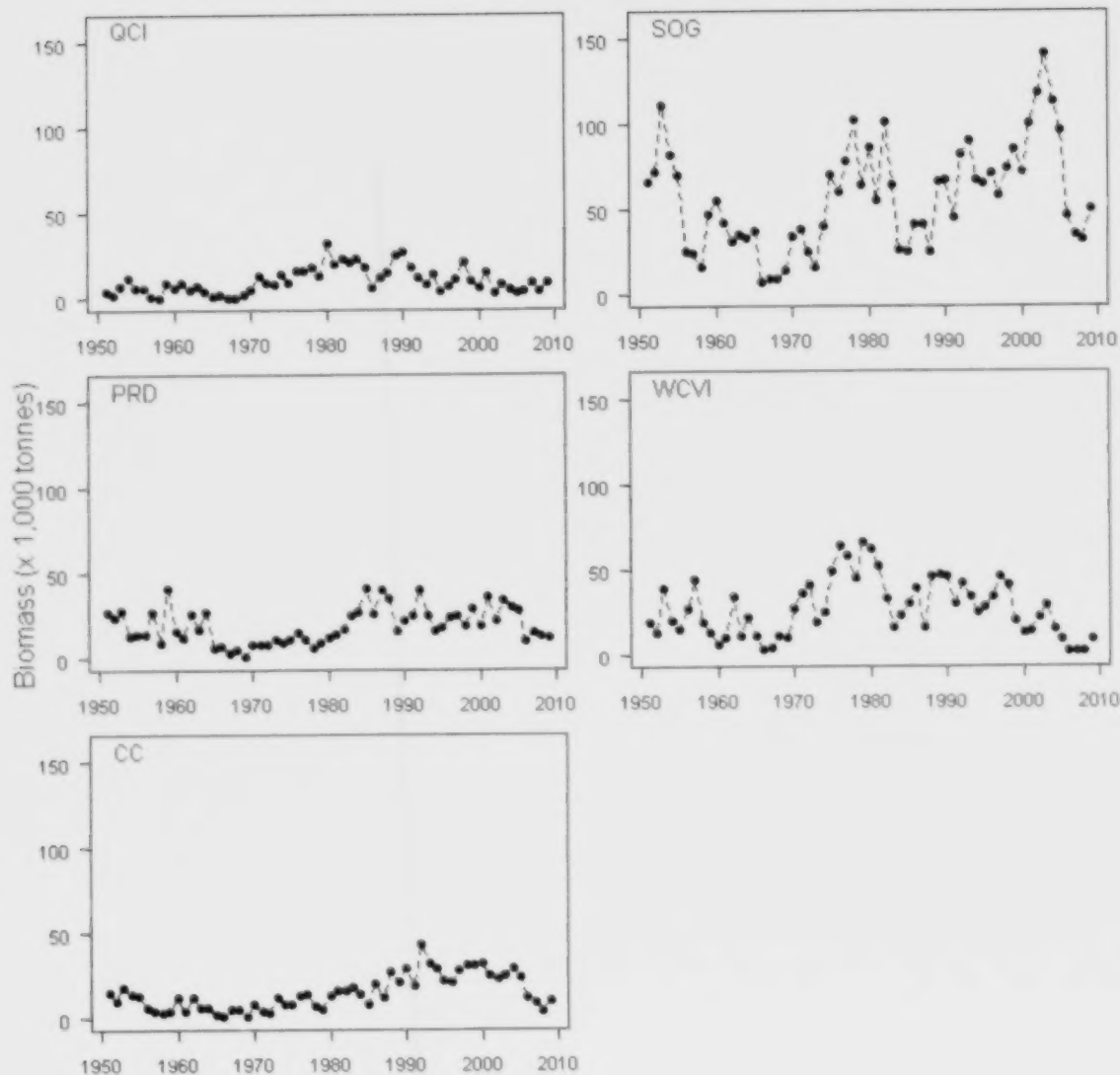


Figure 5. Spawn survey index for the major stock areas from 1951-2009.

### 3.3. Biological samples

Biological samples are collected from both the commercial catch and from pre-fishery charters. Beginning in 1975, charters were intended to supplement biological samples in areas where catch samples are low or not representative of the entire stock, or in areas where fisheries are closed. Pre-fishery charters were also funded through an allocation of fish to the test program, thus since 2006 there has been a reduction in the number of biological samples collected by charter vessel. Through a contract with DFO, the Herring Conservation and Research Society (HCRS) sub-contracts a number of vessels to collect biological samples. Industry also conducts pre-season test sets for roe-quality testing (in open areas only) and supplementary biological samples are provided as part of this program. For

each of these samples, fish length, weight, age, sex, and maturity is recorded, information which then becomes input data for the assessment model.

During the 2008/09 season a total of 222 biological samples were collected, of which 58 were collected from the roe fishery, 11 from the food & bait fishery, 127 from the test fishery, 17 from SOK operations, and 9 from research surveys. Note that each "sample" collected is comprised of approximately 100 fish. A summary of biological samples collected from commercial and pre-fishery charters from 2002/03-2008/09 is presented in Table 1.

*Table 1. Summary of biological samples collected and processed from commercial and pre-fishery charters from 2002/03-2008/09.*

Fishing season	Commercial fishery samples	Charter and research samples	Total <sup>1</sup>
2008/09	86	136	222
2007/08	116	103	219
2006/07	114	85	199
2005/06	49	164	213
2004/05 <sup>2</sup>	83	191	274
2003/04	79	222	301
2002/03	120	287	407

<sup>1</sup> One-sample  $\approx$  100 fish.

<sup>2</sup> DFO ageing lab implemented an annual cap for the Pelagics group, which is now set at 28,400.

### **3.3.1. Age composition data**

Ageing data, through the reading of fish scales, are collected from the biological samples taken from the commercial fisheries and pre-fishery charters. Age composition data is used to determine the catch-at-age and is an essential source of input data to the herring stock assessment model. Percent age composition for each area by year and gear-type are included in Appendix Tables 1.1 to 1.7. Observed proportions-at-age for each of the five major stock areas from 1951-2009 are presented in Figure 6.

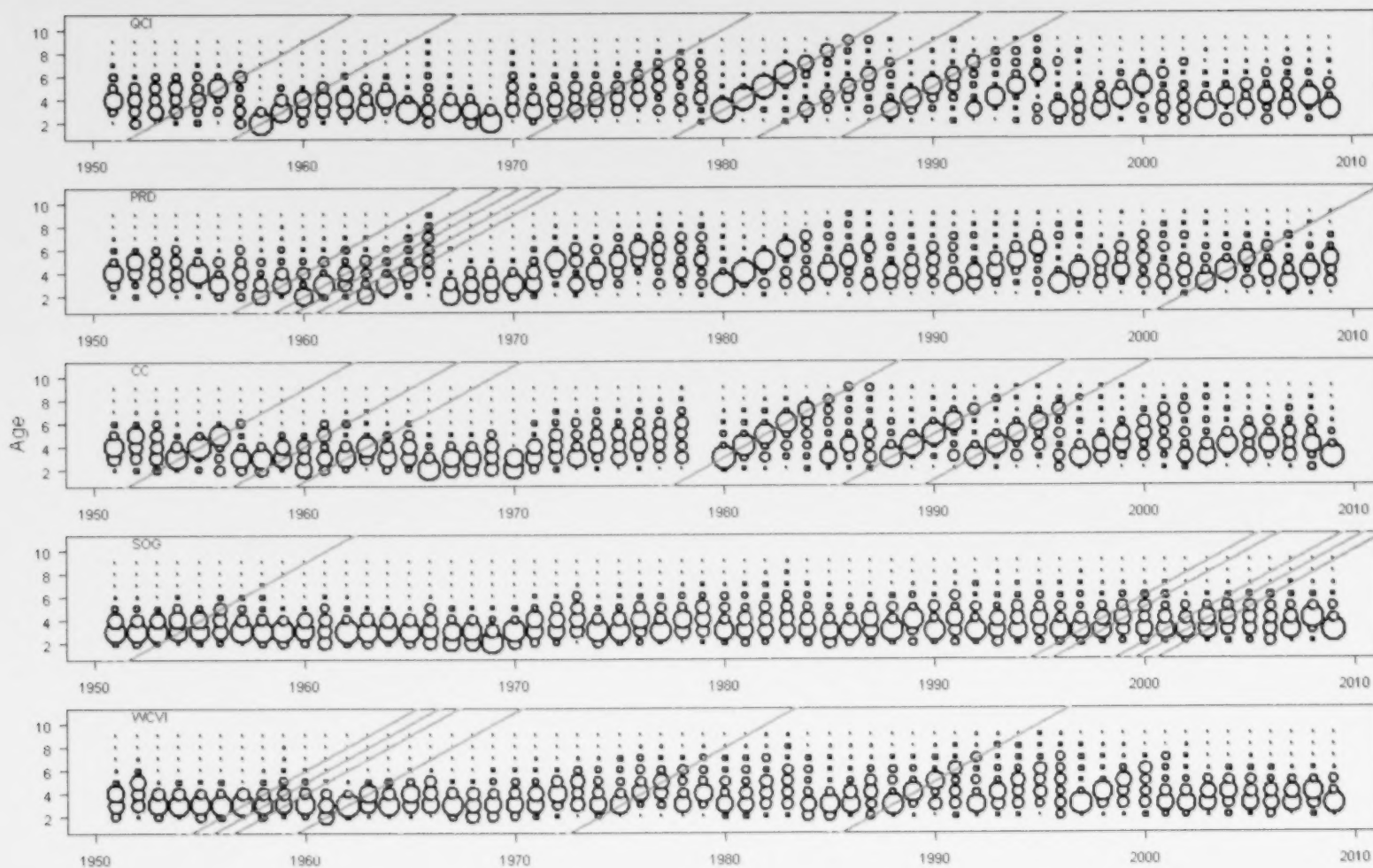


Figure 6. Bubble plots represent observed age proportions for the five major stock assessment regions from 1951-2009. Red lines identify a number of strong year classes, defined as years with the top 10% of model-predicted age-3 recruits.

Above average or strong year classes are represented by diagonal red lines. These cohorts are named for their year of hatch (i.e., age 0). For example, the 1977 year class is strongly visible in the northern stocks, QCI, PRD and CC, recruiting to the fishery as 3-year olds in 1980. Several strong year classes appear in the WCVI stock, for example: the 1985, 1989 and 1994 year classes, recruiting to the fishery in 1988, 1992 and 1997, respectively. In the most recent years, 2006 appears to be a strong year class for QCI, CC, SOG and WCVI, recruiting to the fishery this year in 2009.

Proportion-at-age bubble plots are a useful tool for tracking cohort strength within a given stock area, however, it is important to avoid drawing conclusions about the size of cohorts across stocks because each bubble plot is scaled to the number of fish within each stock. Furthermore, red lines in Figure 6 identify years with the top 10% of model-predicted age-3 recruits but they don't necessarily identify all years considered to be strong year classes (e.g., PRD 1977 is not included).

### **3.3.2. Weight-at-age**

From the mid-1970s until the present, there has been a measureable decline in weight-at-age for all ages in all major stock areas (Figure 7). Samples collected during the 2008/09 fishing year indicate weights-at-age that are among the lowest on record (Figure 8- blue circles). This declining weight-at-age may be attributed to any number of factors, including: fishing effects (i.e., gear selectivity), environmental effects (changes in ocean productivity), or it may even be attributed to changes in sampling protocols (shorter time frame over which samples are collected). Declining weight-at-age has been observed in all five of the major stocks, and despite area closures over the last 10-years, has continued to occur in the QCI and WCVI stocks. Although the direct cause of this decline is still to be investigated, this trend has been observed in B.C. and U.S. waters, from California to Alaska (Schweigert et al. 2002), and merits further research.

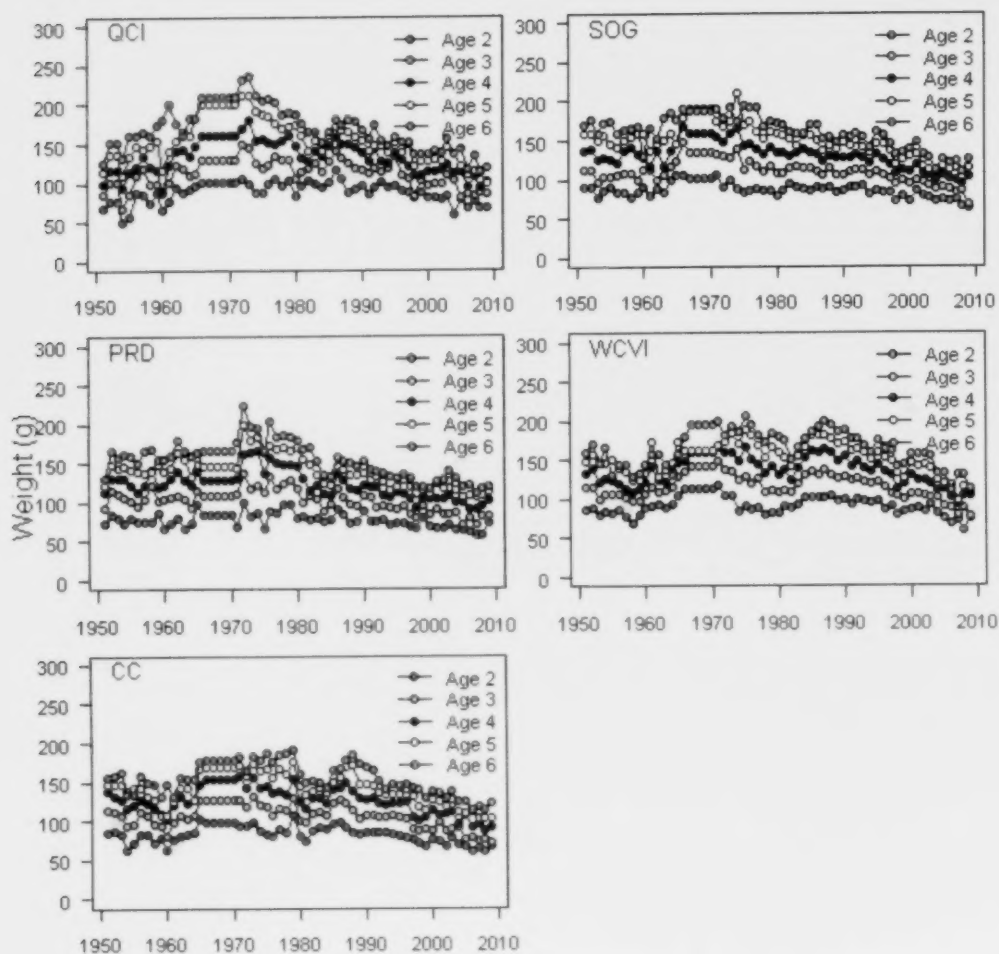


Figure 7. Time series of mean weight-at-age (in grams) for herring ages 2-6 for all major stock areas. Note that data extrapolation methods were used to fill in weight-at-age data for years following the reduction fishery closure (1965-1970).

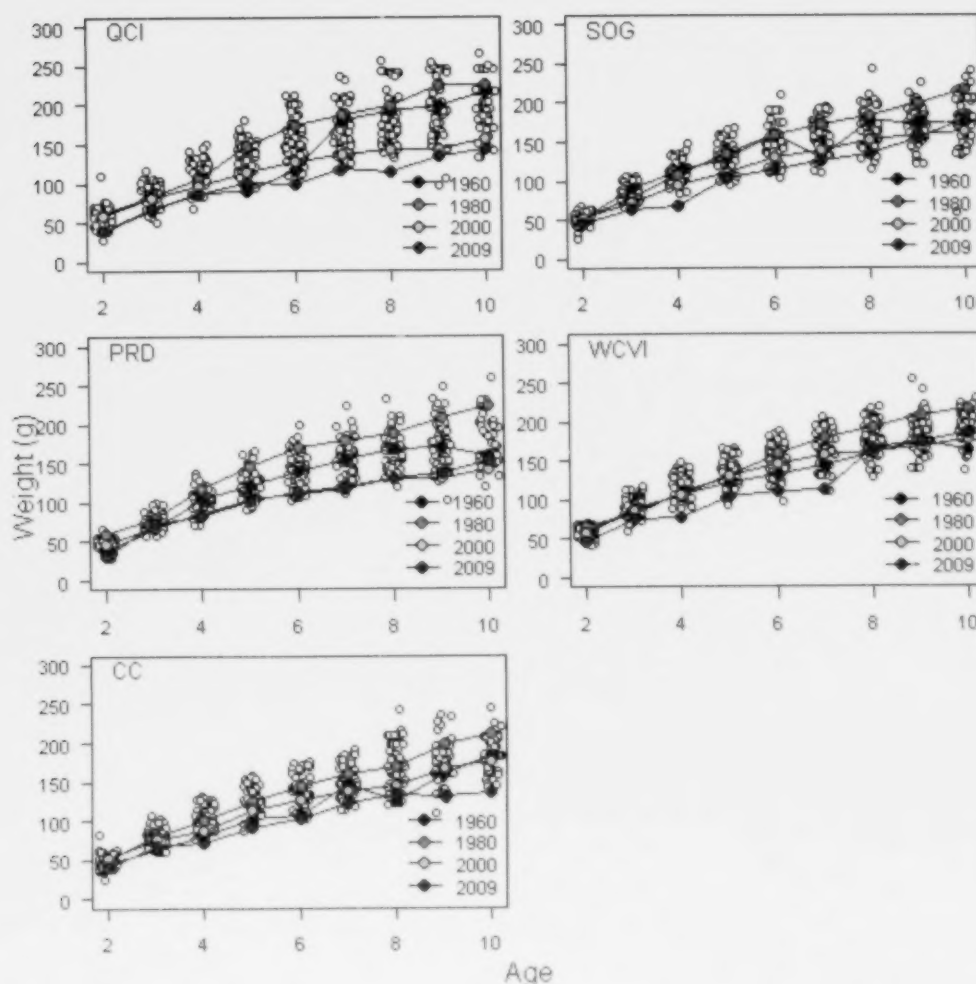


Figure 8. Mean weight versus age for all years from 1951-2009. Open circles represent mean weight for ages 2-10 for years 1951-2009. Coloured circles (black, red, green and blue) show 20-year increments of mean weight for each age.

## 4 Methods

Input data and a complete description of the herring catch age model (HCAMv2) is provided in Appendices A and B, respectively. Additional details on model choice can be found in Christensen et al. (2009) and Haist and Schweigert (2006) while management of the B.C. herring fishery is summarized in Stocker (1993).

Overall, this year's assessment uses the same modelling approach as was used in the 2008 herring stock assessment. Two changes were made to the HCAMv2 model, the first relates to the way in which ageing samples are used by the model and the second relates to the bounds of the fishing mortality rate. We discovered that for the 2008 assessment, a number of ageing samples were not making it into the assessment model. Specifically, for each area, ageing samples were being missed in



years where there is no catch for the roe seine fishery. This change led to minor differences in estimated spawning stock biomass and pre-fishery biomass for the QCI and CC stocks (not shown) and noticeable differences for minor stock Area 2W. Results presented in the 2009 assessment reflect this year's adjustment to the HCAMv2 model, as well as a related adjustment to the lower bounds used to constrain the fishing mortality rate. The only exception occurs in Section 6, where for comparative purposes, we've included Area 2W-A, the 2008 configuration of HCAMv2, and Area 2W-B, reflecting this year's changes.

## 4.1. Modelling approach

The general modelling approach used in the herring stock assessment is to fit a catch-age model to a time series of commercial catch data, spawn index and proportions-at-age data within a Bayesian estimation framework. The objective function contains four likelihood components related to: 1) age composition, 2) commercial catch, 3) spawn data, and 4) prior distributions for model parameters. The model allows parameters to be estimated using Bayesian estimation procedures whereby marginal posteriors are approximated using the Markov Chain Monte Carlo (MCMC) routines built into AD Model Builder (Otter Research, 1994). Posterior samples were drawn systematically every 1,000 iterations from a chain of length 2,000,000, resulting in a sample of 2,000 points for the QCI, CC and WCVI stocks. Problems with model convergence prompted us to use longer chains for PRD and SOG where posterior samples were drawn every 10,000 iterations from chains of length 20,000,000 to yield a sample size of 2,000 points.

Model runs were examined for convergence using visual inspection of the trace plots. Where possible, we provide comparisons between the mode of the posterior distribution, MPD, also equivalent to the maximum likelihood estimate (MLE), and median estimates from the marginal posterior distributions. Catch advice is based on model forecasts calculated from the posterior distributions under assumptions of poor, average and good recruitment.

## 4.2. Parameter estimation

A significant component of model implementation is parameter estimation. The 2009 implementation of HCAMv2 estimates 136 parameters plus fishing mortality parameters for each period-year combination, for a total of 208, 242, 228, 271 and 220 parameters for the QCI, PRD, CC, SOG and WCVI stocks, respectively. During parameter estimation, the model also generates predicted values of commercial catch, spawning biomass, and age composition. A comprehensive description of parameter estimation and model equations is provided in Appendix B.

For the purposes of gauging model fit and precision of the parameter estimation procedure, the results section includes a number of comparisons between observed and predicted indices, as well as distributions of parameter estimates (and priors where applicable).

## 4.3. Priors

Model priors are an integral component of the Bayesian estimation procedure and are based on existing knowledge of parameter values and/or herring biology, derived either from previous studies or expert opinion. In the 2009 implementation of the HCAMv2, we include priors for estimating average or total mortality, deviations in natural mortality, deviations in recruitment and steepness. The prior for steepness also includes upper and lower bounds, as defined by the Beverton-Holt stock recruitment relationship. Prior distributions are described in Table 2.

Table 2. Prior distributions for model parameters for all major and minor stock areas.

Parameter	Prior density	Range <sup>2</sup>	Mean	Median	SD
Average natural mortality rate	normal	-	0.45	-	0.2
Residual deviations in average natural mortality rate	normal	-	0.0	-	0.1
Recruitment deviations	normal	-	0.0	-	0.8
Steepness <sup>1</sup>	lognormal	(0.2 -0.99)	0.67	-	0.17
Initial fishing mortality	lognormal	-	0.3945	0.3166	-

<sup>1</sup> Hilborn, pers. comm. with Schweigert, comparable to Myers *et al.* (1999) estimate of 0.74 for Atlantic herring. Note this prior should be changed to a beta distribution to naturally bound steepness between 0.2 and 1.0.

<sup>2</sup> Steepness is the only parameter with a bounded prior. Upper and lower bounds are used during the estimation procedure for other parameters but they are not related to model priors, thus are not included in Table 2.

Remaining "free" parameters,  $R_0$ ,  $q_1$ ,  $\psi$ , are assumed to be uniformly distributed, although the range of some of these uniform distributions may be restricted using upper and lower bounds (e.g.  $q_2 \sim U[0.3, 1.2]$ ).

#### 4.4. Retrospective analysis

A retrospective analysis is used to examine the sensitivity of estimates of pre-fishery biomass to the addition or removal of new data (for the major stock areas). Our retrospective analysis includes the successive removal of 10-years of data. Warning signs include persistent over- or under-estimation of pre-fishery biomass, with the latter being less of a concern to DFO Science (with respect to conservation) than the former.

#### 4.5. Abundance forecasts

The assessment model includes a component for forecasting herring abundance for the upcoming fishing year. The forecast of pre-fishery biomass, referred to as 'forecast run', is calculated as:

$$\text{Forecast run} = \text{predicted spawning biomass of fish age 4 and older in year } t=T+1 \\ + \text{ predicted recruitment of age 3 fish in year } t=T+1$$

For each stock, the forecast is calculated under each assumption of poor, average and good recruitment (Section 4.6). Equations describing these calculations appear in Appendix B.

#### 4.6. Recruitment forecast rules

Independent estimates of recruitment for the WCVI and SOG stocks are based on offshore survey data collected during the summer prior to the recruitment of age 3 fish to the spawning population. Recruitment forecasting methods were first applied in 1999/2000 for the WCVI stock (Tanasichuk 2000) and in 2005/06 for the SOG stock (Tanasichuk 2002). Comparable methods for the QCI, CC and PRD stocks are not available, thus recruitment is based on the following precautionary rules:

1. If the pre-fishery biomass was below cutoff in the previous year, then assume POOR recruitment for the forecast.

2. If the pre-fishery biomass was above cutoff in the previous year and recruitment has been GOOD in the previous two years, then assume GOOD recruitment for the forecast.
3. If Rule 1 or Rule 2 DO NOT APPLY then assume AVERAGE recruitment for the forecast.

The calculation of area-specific cutoffs is described in Section 4.7.1. For all assumptions of recruitment, recommended harvest rates follow the rules outlined in Section 4.7.2.

#### 4.7. Harvest control rule

A formal harvest control rule (HCR) has been used to provide advice for the management of major B.C. herring stocks since 1986 (Stocker 1993). The herring HCR has three components:

1. Reference point
2. Harvest rates
3. Decision rules

These are the same three components identified within the DFO Harvest Strategy Compliant with the Precautionary Approach (DFO 2006), a key component of the Sustainable Fisheries Framework (SFF 2009).

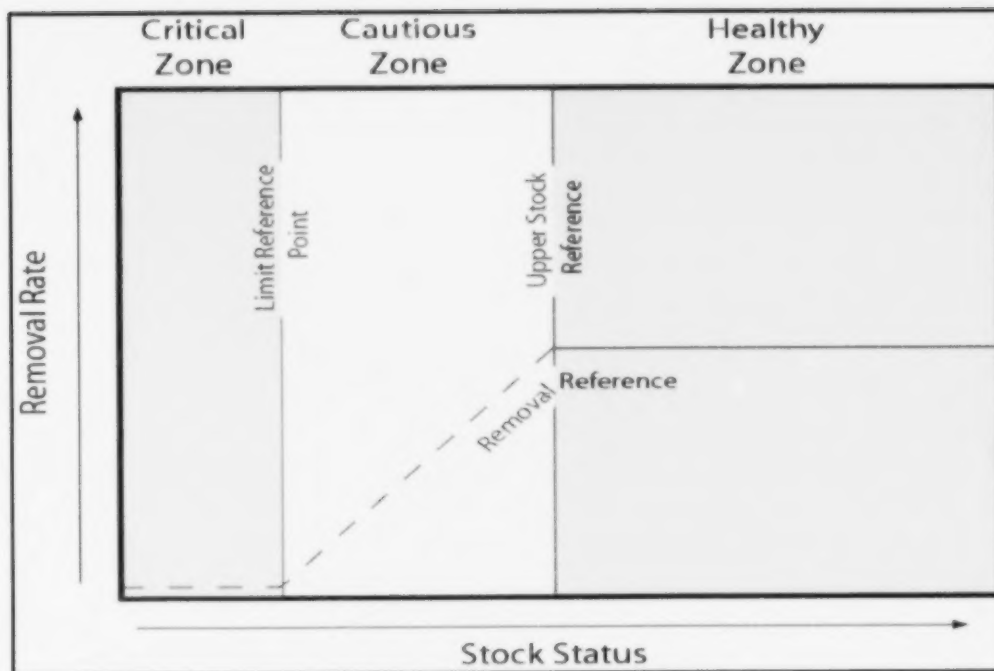


Figure 9. The DFO Harvest Strategy compliant with the Precautionary Approach.

In Figure 9, the limit reference point, defined as  $0.4B_{MSY}$ , separates the critical and cautious stock zones while the upper stock reference point, defined as  $0.8B_{MSY}$ , separates the cautious and healthy stock zones. The removal reference defines the maximum acceptable removal rate which is constant in the healthy zone, reduced in the cautious zone and negligible (little or no targeted catch) in the critical zone. This harvest strategy is intended to keep the removal rate moderate when stock status is healthy, promote rebuilding when stock status is low and ensure a low risk of serious or irreversible harm.

Figure 10 shows the harvest control rule for B.C. herring stocks. The main differences between these figures are the "width" of the cautious zone and the existence of only a lower reference point, the cutoff, for the herring HCR.

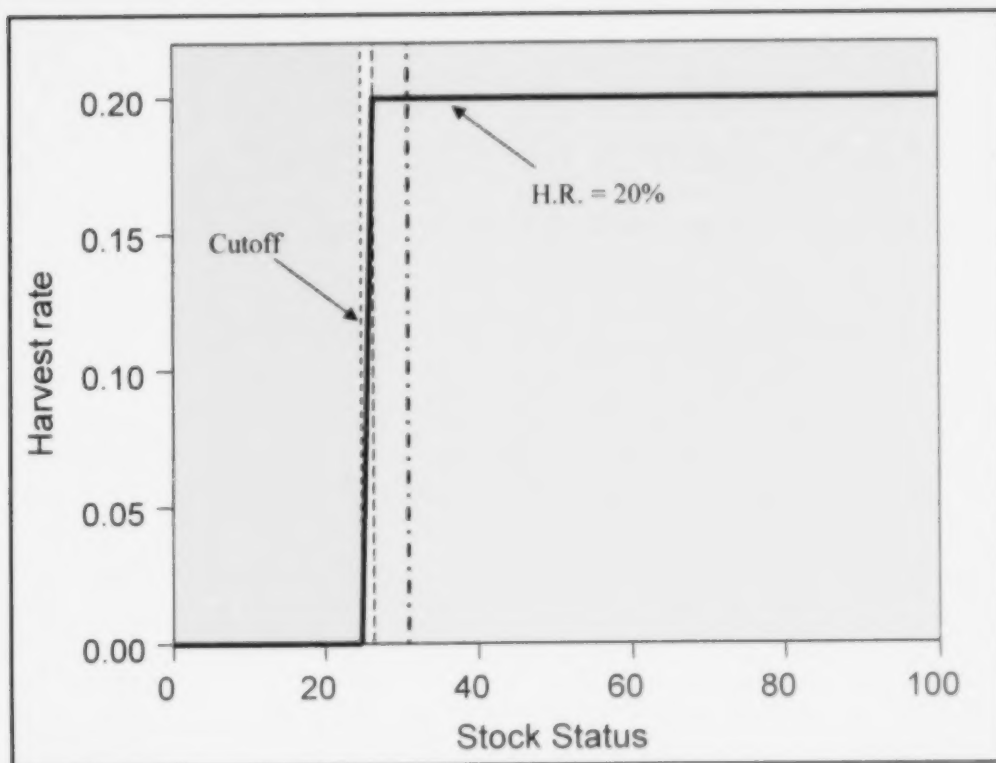


Figure 10. Harvest control rule for B.C. herring stocks, where stock status is defined as a percentage of the estimated virgin biomass. The left-hand dashed line represents the cutoff value for a given stock, i.e., the stock level below which the harvest rate,  $H.R.$ , is zero. The right-hand dashed line represents the stock level below which the  $H.R.$  is reduced below 20%. The dash-dot line is the biological reference point  $B_{MSY}$  (biomass at maximum sustainable yield). Note this figure was produced using a generic operating model.

We recognize that evaluating compliance of the current herring HCR with the DFO harvest strategy is a necessary next step. We intend to carry out this comparison using a simulation framework in the context of a management strategy evaluation (MSE).

#### 4.7.1. Reference points

The reference point or cutoff for the herring HCR is  $0.25B_0$ . For each major stock area, the cutoff is intended to ensure a minimum spawning biomass of 25% of the estimated unfished biomass ( $B_0$ ). Past simulation studies indicate this minimum spawning stock biomass is adequate to sustain each population during natural reductions in stock productivity (e.g. Haist et al. 1986, Hall et al. 1988). A similar reference point criterion is also used in managing the Pacific sardine fishery (PFMC 1998).

Because of the way they are defined, herring cutoffs are considered commercial fishing thresholds and not conservation thresholds and are thus thought to be more conservative than the default Limit Reference Point of  $0.4B_{MSY}$  included in the DFO harvest control rule (DFO 2006). However, as previously mentioned, to ensure compliance of the herring HCR with the DFO Harvest Strategy and the Precautionary Approach, an evaluation of these and alternate reference points in a simulation framework is planned for the near future.

Estimates of unfished biomass used in the calculation of current cutoff levels were calculated using simulation methods, either using a stock recruitment relationship or by bootstrap sampling of the historic recruitment time series.

Table 3. Current and historic cutoff levels incorporated into the B.C. herring harvest control rule for the major stock areas.

	Cutoff levels			Current
	1992/93 <sup>a</sup>	1994/95 <sup>b</sup>	1996/97 <sup>c</sup>	
QCI	11,700	10,700	10,700	10,700
PRD	12,100	12,100	12,100	12,100
CC	10,600	18,800	17,600	17,600
SoG	22,100	21,200	21,200	21,200
WCVI	20,300	18,800	18,800	18,800

<sup>a</sup> Cutoff levels based on simulation model with stock recruitment relationship and two assessment areas on the WCVI (Schweigert and Fort 1994).

<sup>b</sup> Cutoff levels revised (Schweigert et al 1995).

<sup>c</sup> Cutoff levels revised (Schweigert et al 1997).

#### 4.7.2. Harvest rates

The Pacific Science Advice Review Committee (PSARC) has reviewed the biological basis for target exploitation rate, considering both the priority of assuring conservation of the resource and allowing sustainable harvesting opportunities (Schweigert and Ware 1995). The review concluded that 20% is an appropriate exploitation rate for those major stock areas that are well above cutoff levels of 25% of the estimated unfished biomass. The recommended 20% harvest rate is based on an analysis of stock dynamics which indicates this level will stabilize both catch and spawning biomass while foregoing minimum yield over the long term (Hall et al. 1988, Zheng et al. 1993).

In the case of minor stock areas, data-limitations present a challenge in providing reliable estimates of unfished biomass, required for the calculation of stock-specific cutoffs. Consequently, the PSARC recommended harvest rate of 10% is applied to the currently estimated biomass for the following year for these areas.

#### 4.7.3. Decision rules

The herring harvest control rule (HCR) was first implemented for the major stock areas in 1983 as a fixed harvest rate of 20% and was augmented with a fishing threshold or cutoff in 1986 (Stocker 1993). Since inception, the rule has remained unchanged, however modifications have been made to model estimates of unfished biomass and consequently to stock-specific cutoff levels (Table 3).

For the major stock areas, the harvest control rule combines both constant exploitation rate and constant escapement policies (Figure 10), allowing for smaller fisheries in areas where the 20% harvest rate would bring the escapement down to levels below the cutoff. The rule operates as follows:

If the forecast run is less than the cutoff.

The area is closed to all commercial harvest (allowable harvest = 0)

*Analogous to the critical zone in Figure 9*

If the forecast run is greater than the cutoff

A commercial harvest is permitted and the H.R. is based on the following rules:

If the forecast run - 0.20 x forecast run is greater than the cutoff

A 20% H.R. is applied  
*Analogous to the healthy zone in Figure 9*

If the forecast run – 0.20 x forecast run is less than the cutoff  
A reduced H.R. equivalent to: forecast run – cutoff is applied  
This represents the constant escapement portion of the rule.  
*Analogous to the cautious zone in Figure 9 but is operationally narrow as is shown in Figure 10.*

In the case of the minor stock areas, the decision to allow for a commercial harvest has been at the discretion of Fisheries Management. In years where a commercial harvest is permitted, a harvest rate of 10% is applied to the estimated biomass for the area.

## 5 Results

The results section contains two subsections: Model estimates (5.1) and Catch advice (5.2); where the former includes figures and descriptions of leading (model-estimated) parameters and the latter includes decision tables for catch advice, with pre-fishery biomass and available harvest presented under three recruitment scenarios: poor, average and good.

### 5.1. Model estimates

#### 5.1.1. Catch: observed vs. predicted

In the herring assessment, we assume commercial catch to be known with a high degree of certainty. This assumption is confirmed by plotting observed and predicted catch (Figure 11) and by examining the residuals (not shown).



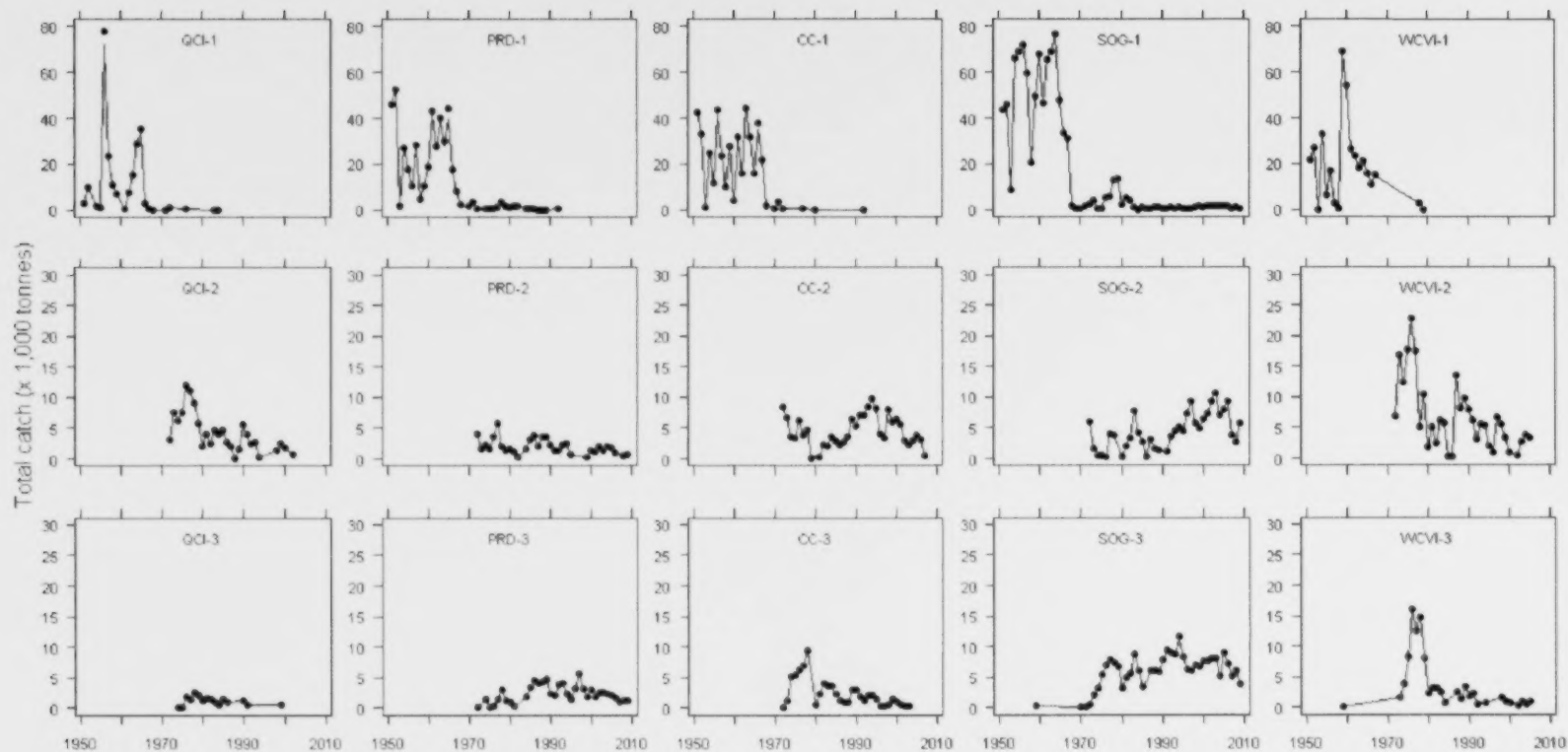


Figure 11. Observed (circles) and model predicted catch (lines) by fishing period from 1951-2009. Upper row- Fishing period 1 – primarily seine and reduction fisheries, except recent years in SOG which represent food and bait/ special use fisheries; Middle row- Fishing period 2 (seine roe fishery); Bottom row- Fishing period 3 (gillnet roe fishery). Note range in y-axis differs for fishing period 1

### 5.1.2. Spawn index: observed vs. predicted

Time series of estimated spawning stock biomass (SSB) fitted to observed spawn index for all major stock areas are shown in Figure 12. An examination of the residuals provides the basis for assessing the fit of the model to the available data. We compare model estimates of population egg production (estimated spawning stock biomass, SSB) to the observed egg deposition (observed spawn index) and calculate the by-year differences, the residuals, as  $\log(\text{observed}) - \log(\text{predicted})$ , adjusted for differences in  $q$  (spawn index proportionality coefficient) for the five major stocks. For all stocks, residuals range from -1 to +1, with a few exceptions in the earlier years, e.g., PRD for 1960s-1970s. In recent years, model estimated spawning biomass is closely fitted to the spawn index, although there are a higher proportion of negative residuals in years preceding the surface surveys (pre-1988). In particular, SOG and PRD stocks show a run of negative residuals from the late 1980s through mid 2000s. Currently we are unsure of the reason for this switch.

The spawn index proportionality coefficient,  $q$ , is used to relate spawn observed during the survey to the total amount of spawn in each area (i.e.,  $q$  is the proportion of the total spawn estimated to have been identified). In years prior to 1988, when surface survey was the primary survey method,  $q$  is estimated as a parameter in the model (see Appendix B) and from 1988-present we make the precautionary assumption that  $q=1$ .

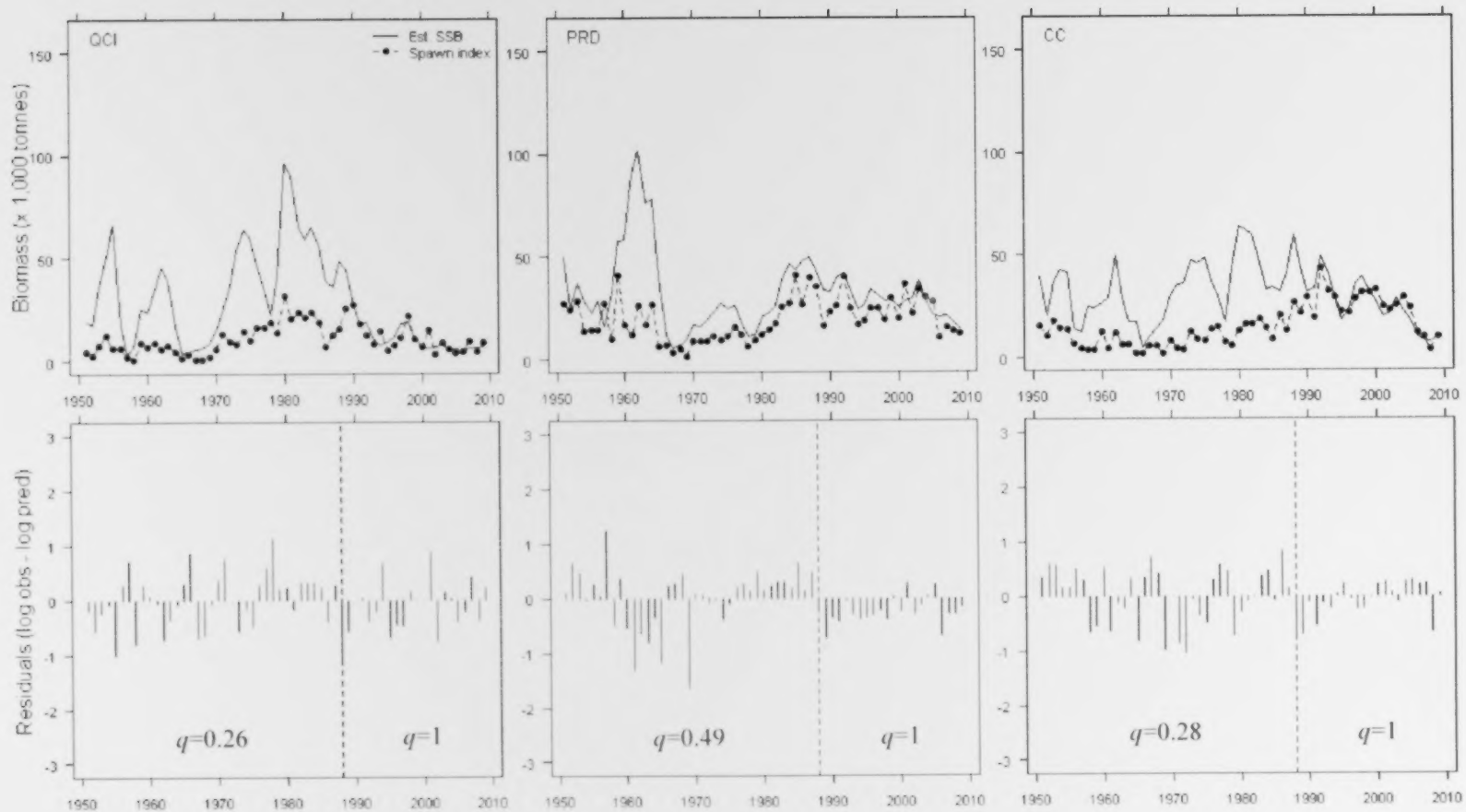


Fig 12. QCI, PRD and CC

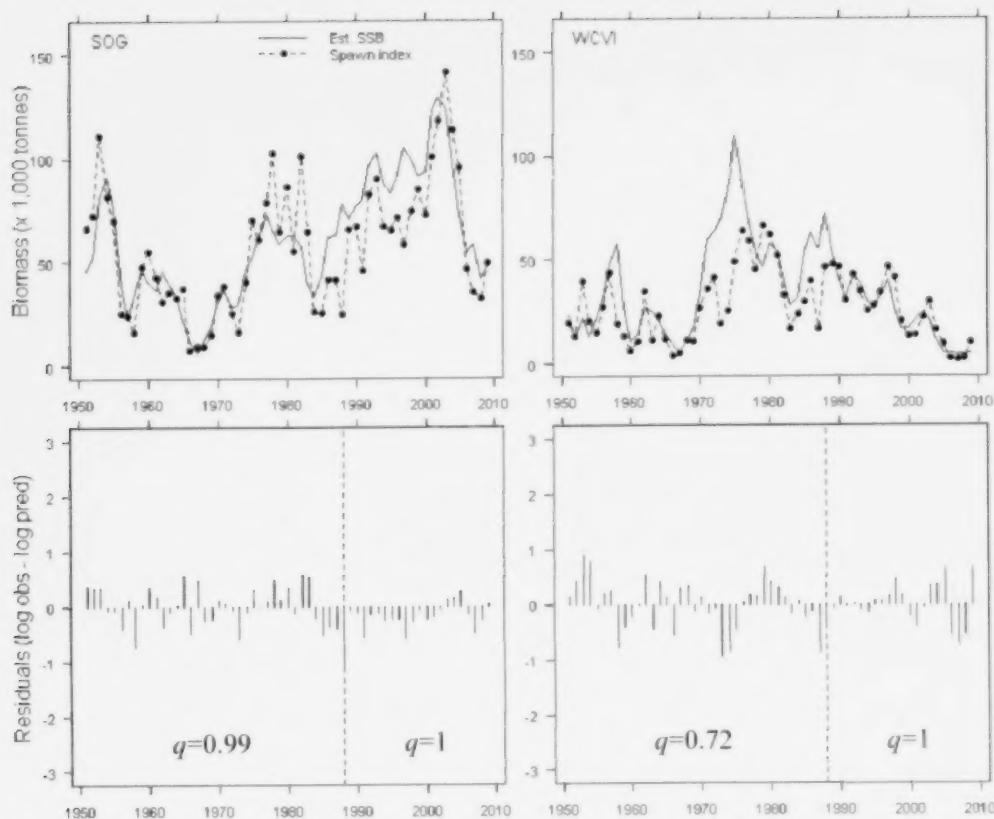


Fig 12. SOG and WCVI

Figure 12. Time series of estimated spawning stock biomass (SSB) fitted to observed spawn index for all major stock areas. Residuals of this relationship appear in the bottom plots. Note that residuals are calculated as  $\log(\text{observed}) - \log(\text{predicted})$ , with values adjusted for differences in  $q$  (spawn index proportionality coefficient). Vertical dashed line in residual plots indicates 1988, the year the spawn survey switched from surface to dive survey. In years prior to 1988,  $q$  is estimated, whereas from 1988-present  $q$  is assumed to be 1. Values of  $q$  appear at the bottom of each residual plot.

### 5.1.3. Age composition: observed vs. predicted

We used standardized Pearson's residuals to summarize the fit of the age-structured model to the observed proportion-at-age data. Residuals are presented in

Figure 13 for each of the five major stocks over time (broken down by fishing period). Positive residuals (blue) indicate the model is under-estimating age proportions for a given year/period, negative residuals (green) indicate an overestimation. There is no evidence of persistent over or underestimation of age composition in any area for any of the three fishing periods indicating reasonable agreement between the observed data and model predictions of age composition. A few larger positive (blue) residuals remain in each area and require further investigation.

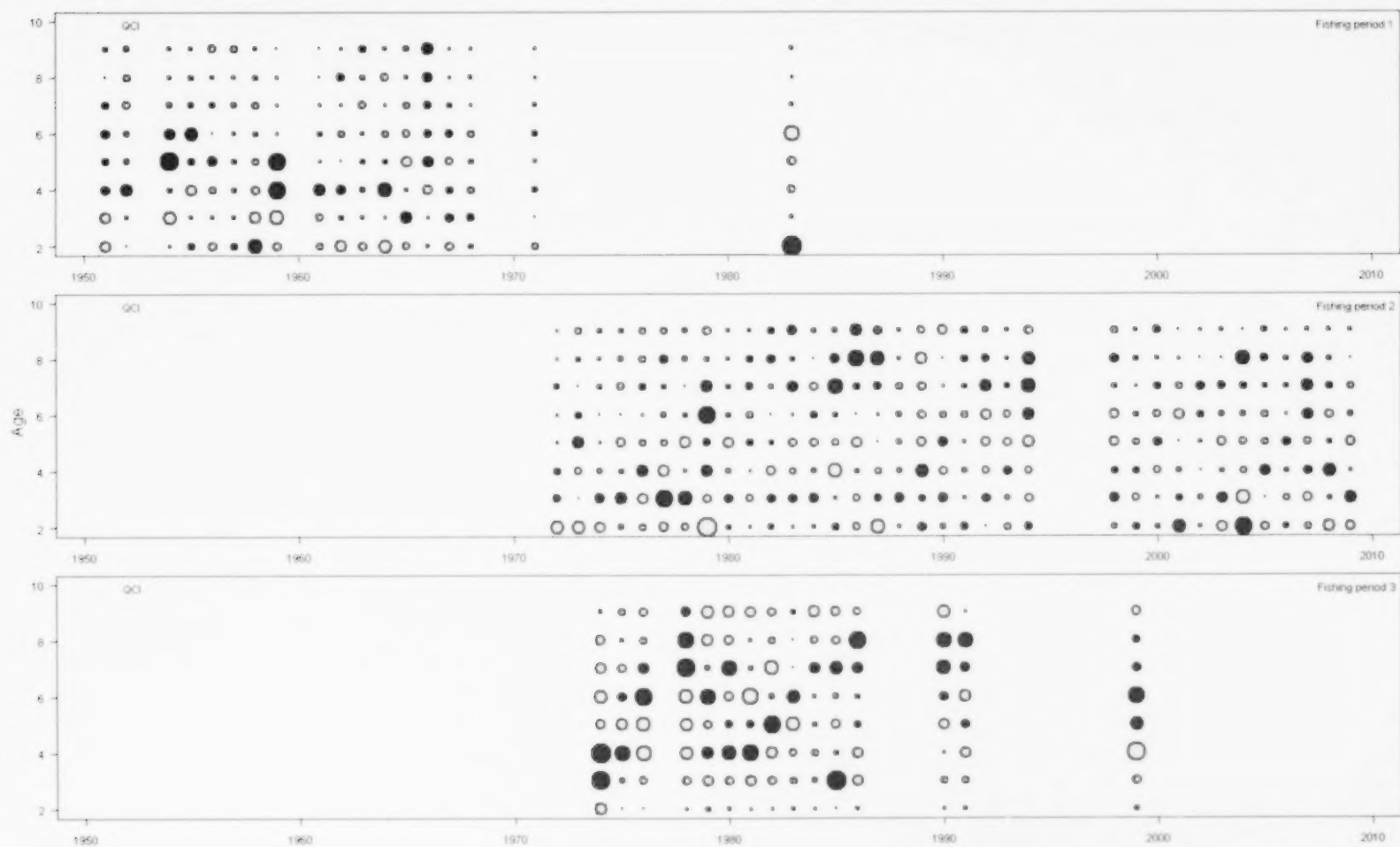


Fig 13. QCI

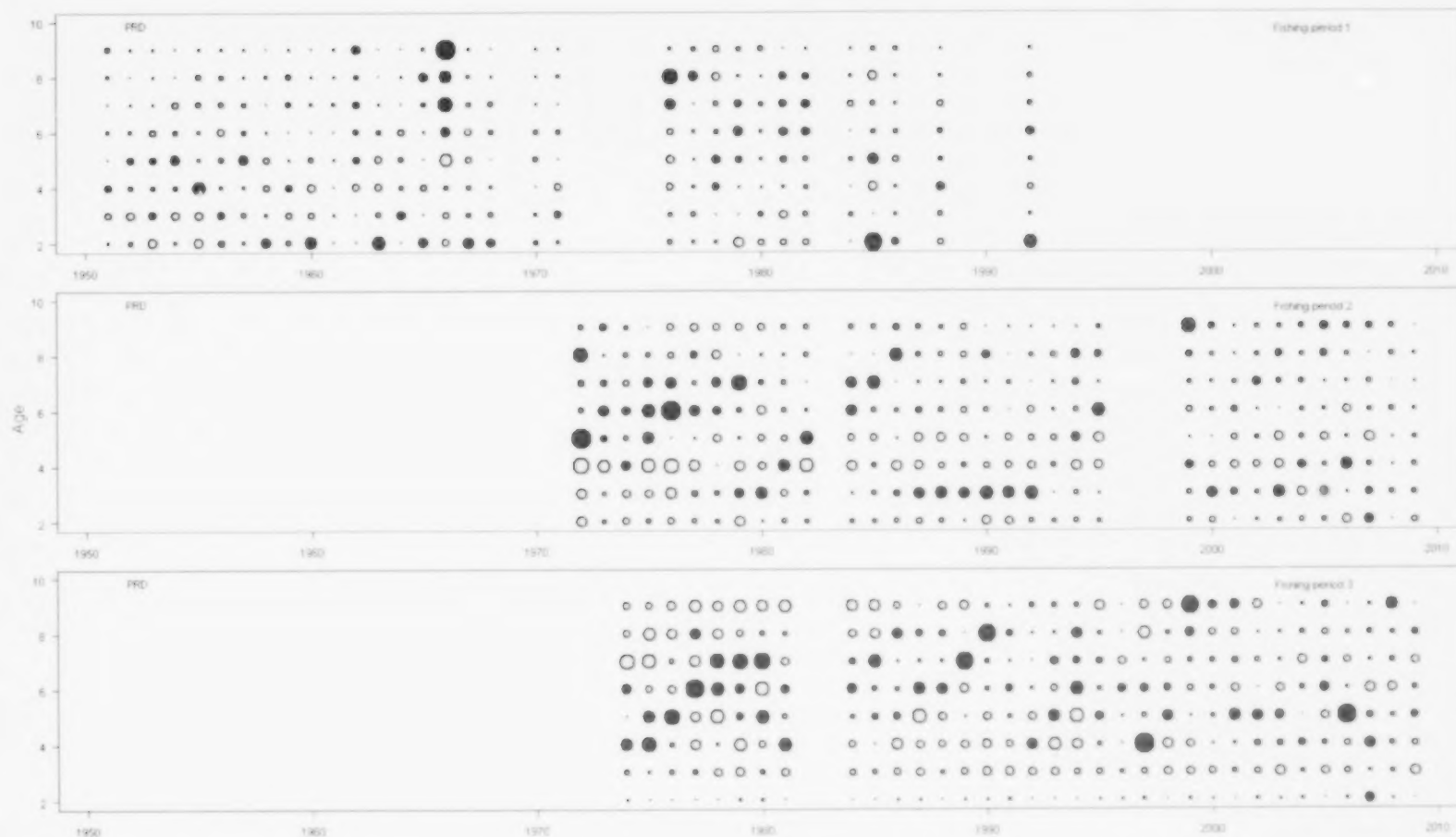


Fig 13. PRD

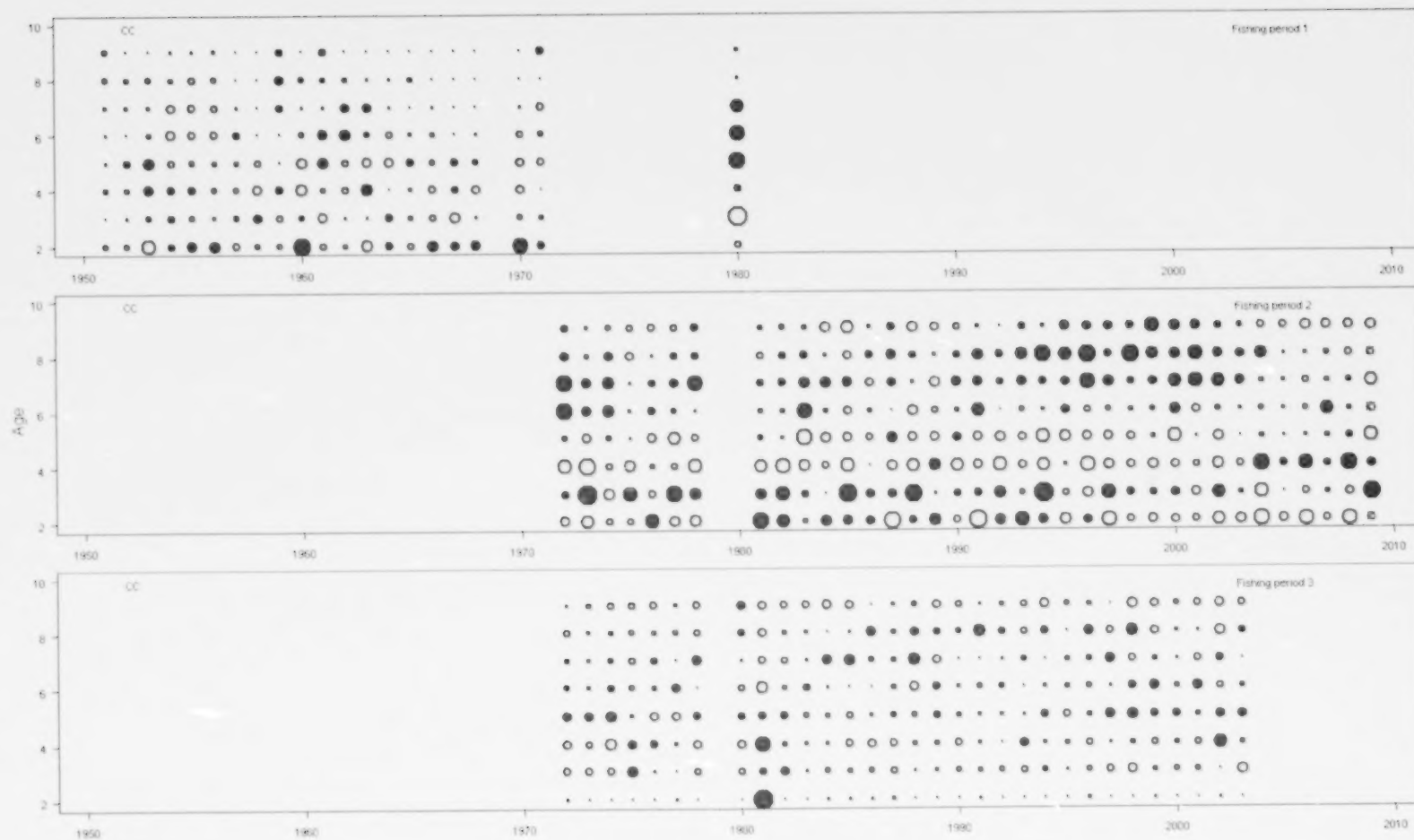


Fig 13. CC





Fig 13. SOG

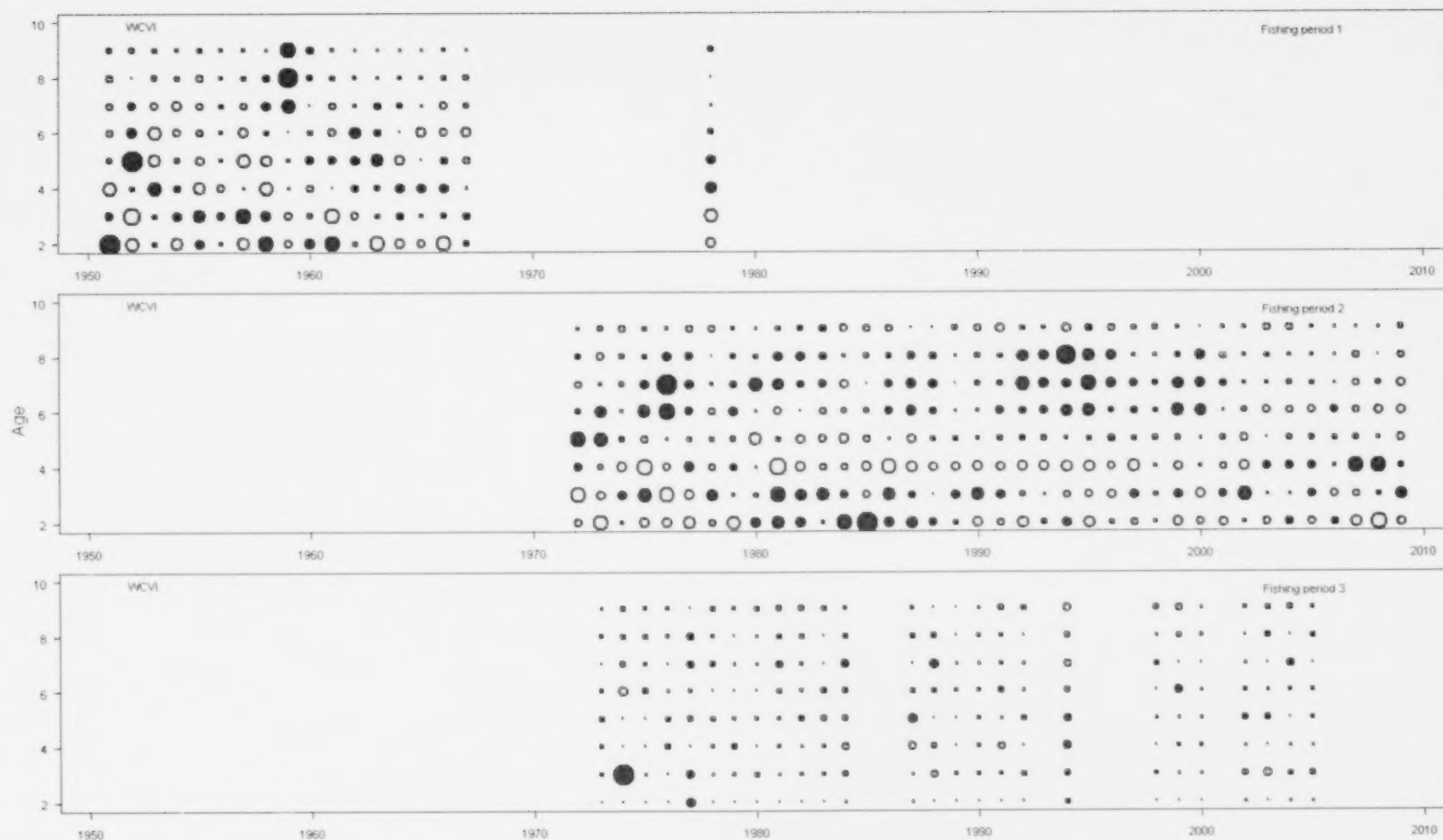


Fig 13. WCVI

Figure 13. Bubble plots of Pearson residuals for the proportions-at-age calculated between observed and model-predicted proportions-at-age for each fishing period from 1951-2009. Positive residuals appear in blue, negative residuals in green.

#### **5.1.4. Recruitment**

Recruitment of age 3 fish is estimated as the number of age 3 fish recruited to the stock at the beginning of year  $t$ . Recruitment is categorized as poor, average or good, and model estimates of recruitment are calculated as the lower 33%, middle 33% and upper 33% of the number of age 3 fish over the entire time series. Numbers of recruits and the poor-average and average-good recruitment category divisions (0.33 and 0.66 quantiles) are presented for each major stock area in Figure 14. With the addition of each year of data, these category divisions change slightly to reflect our updated view of poor, average and good recruitment. Based on this year's information, the QCI stock area appears to be alternating between poor and average recruitment (over the past 10-years), with average recruitment occurring in 2009. The 2008 assessment assumed poor recruitment for the QCI 2009 forecast (DFO 2008), although this difference can likely be explained by the inclusion of additional ageing data. Figure 14 shows average recruitment for the CC stock (2008 assessment assumed poor) whereas the PRD stock appears at the divide between poor and average (2008 assessment assumed average). The SOG stock shows a strong assumption of good recruitment while the WCVI stock maintains a trend of poor recruitment. Recruitment assumptions for both the SOG and WCVI stocks reflect predictions provided by the 2008 off-shore recruitment forecast survey (DFO 2008).

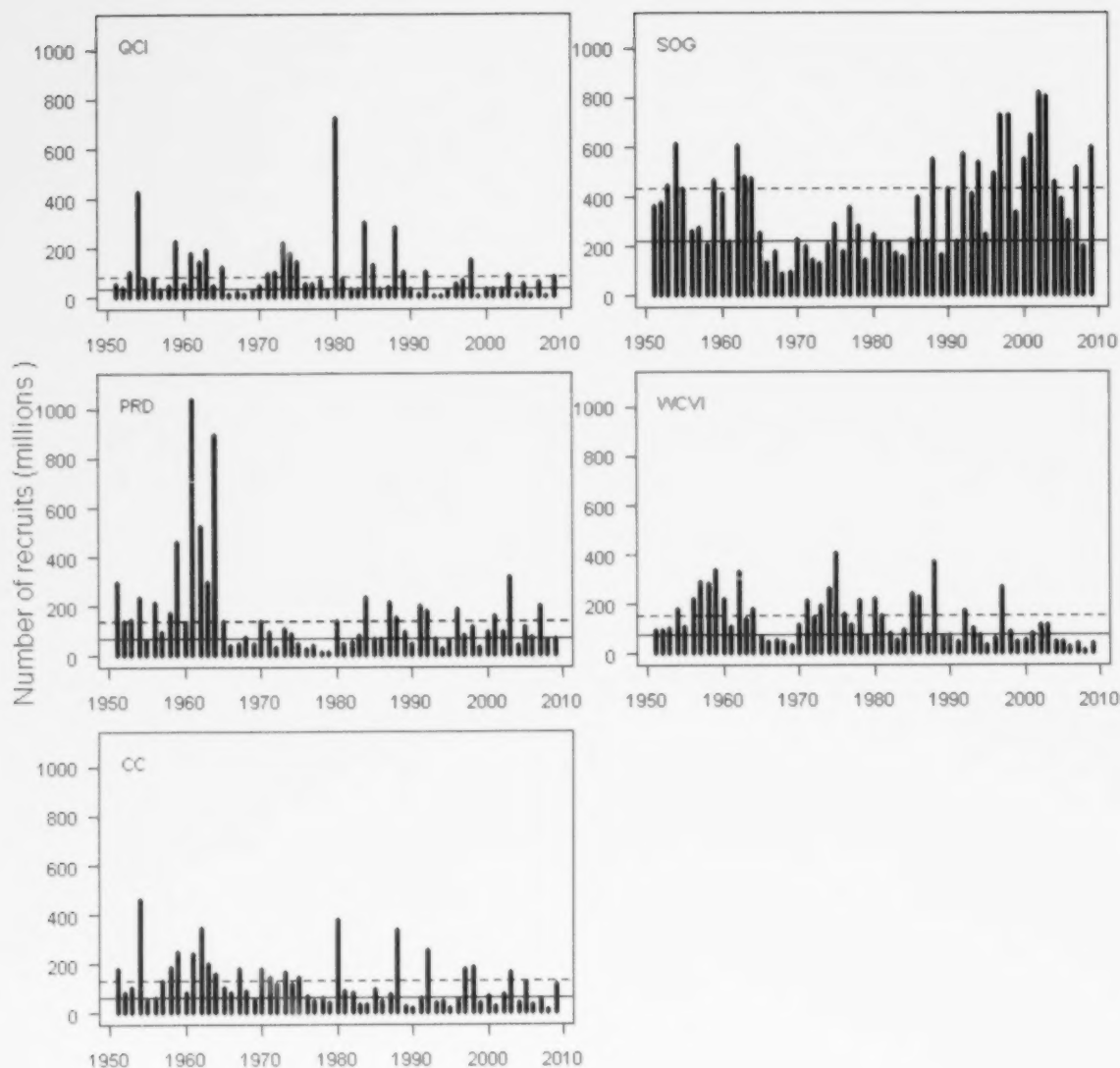


Figure 14. Estimated number of age 3 fish recruiting to the stock in each of the major stock assessment areas. Upper dashed lines represent division between good and average categories of recruitment, lower solid lines represent division between average and poor recruitment. Divisions were calculated as the 0.33 and 0.66 quantiles of the historic numbers of age 3 fish across all years. Recruitment categories for 2009 are as follows: QCI- average; PRD- poor-average; CC- average; SOG- good; WCVI- poor.

#### 5.1.5. Gillnet selectivity

Fishery selectivity is estimated separately for all three fishing periods using three different logistic equations (see Appendix B, Model description and documentation). Figure 15 shows the selectivity function for the roe gillnet fishery, estimated using a weight-based logistic function. The average selectivity curves (thick lines) imply that on average herring are not fully-selected to the gillnet fishery

until age 8-9. Based on the way the fishery operates, we would expect herring to be fully selected at a younger age, i.e., 6-years, thus future work should examine adjusting parameters of the selectivity function to more closely reflect operations of the gillnet fishery. For the SOG stock, the observed declines in selectivity at older ages are the result of lower observed fish weight for ages 9-10 than for ages 7-8. Future work should also include comparisons of gillnet and seine selectivity functions to determine whether differences between these functions is reasonable and accurately reflects fishery operations.

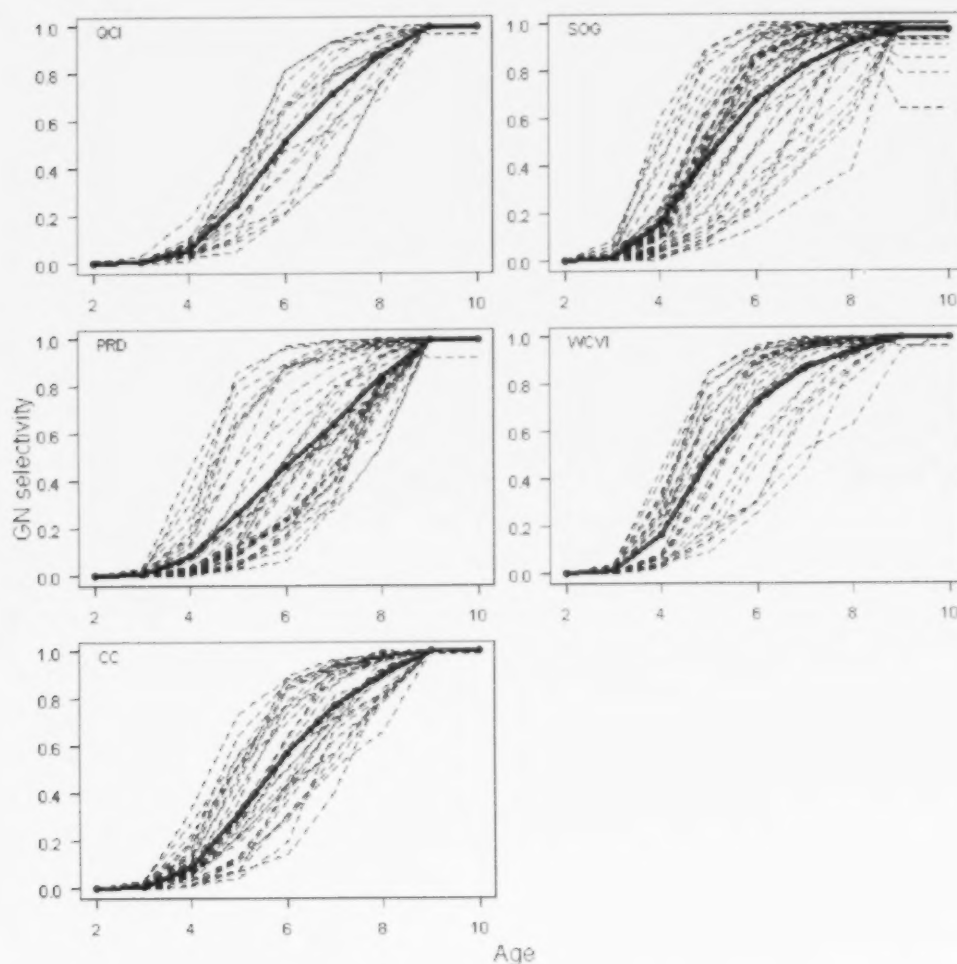


Figure 15. Fishery selectivity for the roe gillnet fishery, estimated using a weight-based logistic function. Each line represents one-year in the time series with average selectivity over all years indicated by the thick black line.

#### 5.1.6. Fishing mortality

From the observed catch, the model estimates the rate of fishing that produced the observed catch, also known as the instantaneous fishing mortality rate. These rates are presented in Figure 16. Historical trends in  $F$  reflect the intensive fishing of the reduction period, while later  $F$  values reflect the comparatively low catch rates of recent years.

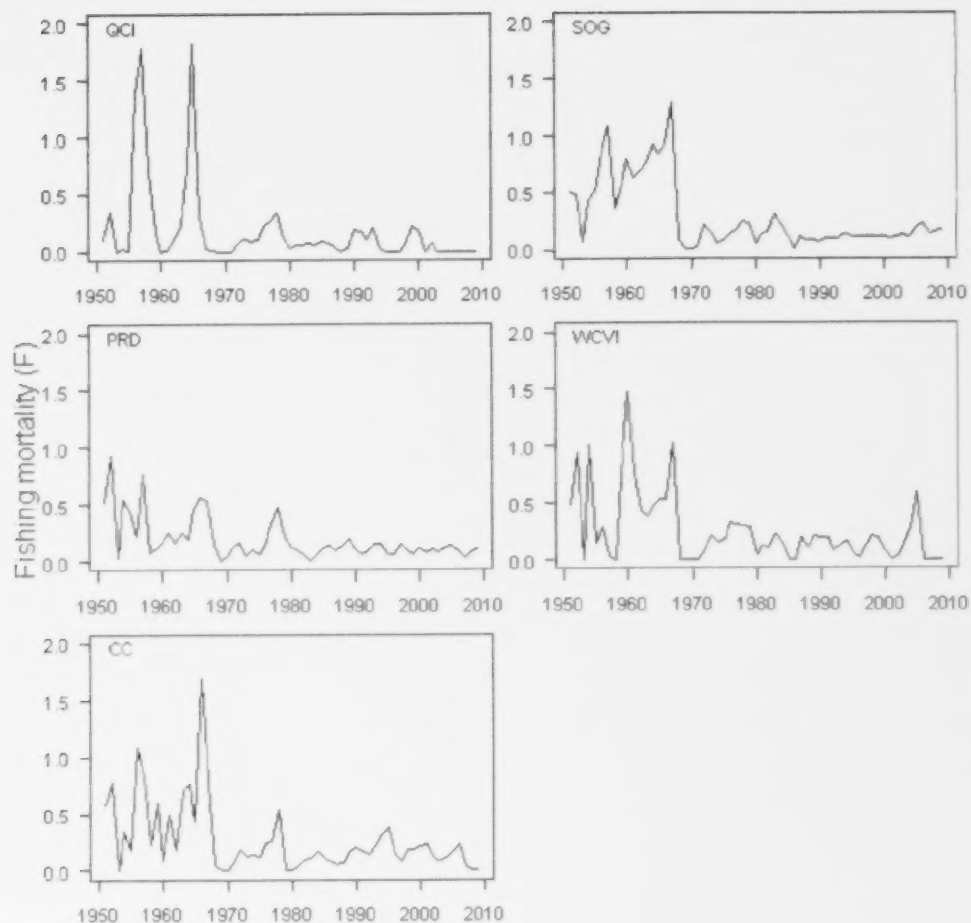


Figure 16. Estimates of annual instantaneous fishing mortality ( $F$ ) for major B.C. herring stocks from 1951-2009.

#### 5.1.7. Natural mortality

Over the years, a number of different methods have been explored for estimating natural mortality for herring stocks, including: fixed and estimated values for constant  $M$ , age-dependent  $M$ , and most recently, annual estimates of  $M$  using a 'random walk' in the estimation procedure (see Appendix B, Model description and documentation). Using this method, natural mortality is shown to be increasing in all major stocks (Figure 17), with the highest observed rates in areas closed to fishing: QCI, CC and WCVI. This implies that despite conservation efforts in the areas (i.e., area closures), recovery potential for these stocks is largely driven by environmental factors and not the impacts of fishing.

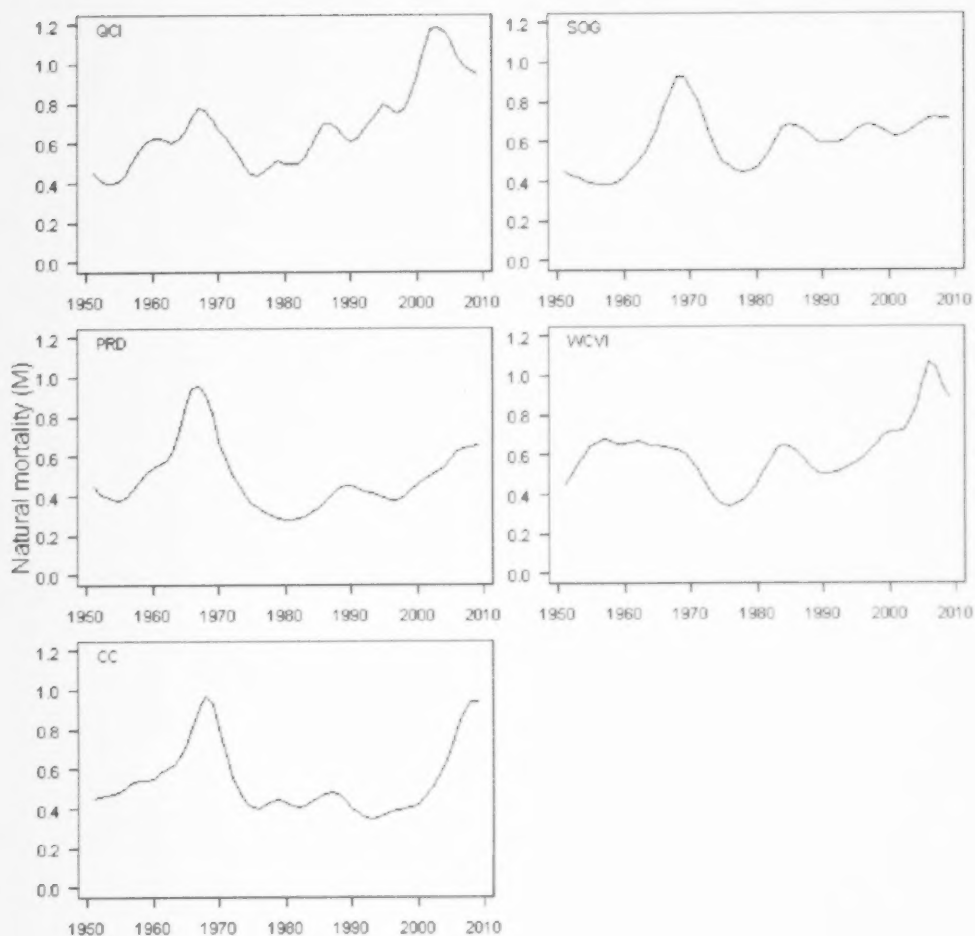


Figure 17 Estimate of the annual instantaneous natural mortality rate ( $M$ ) for the B.C. herring stocks from 1951-2009, calculated using a random walk approach. Natural mortality rates for 2009 are as follows: QCI- 0.95; PRD- 0.68; CC- 0.94; SOG- 0.71; WCVI- 0.89.

It is difficult to determine whether these high  $M$  values are an accurate reflection of herring biology in this current 'low productivity' regime, or whether these estimates of natural mortality are capturing noise from other parameters. Due to the way the model equations are defined, parameters such as  $F$  and  $h$  (steepness) can be confounded with natural mortality, meaning that when we make a change to one of these parameters this change can be detected in the others. We ran a number of simulations to test the response of changes in  $M$ ,  $F$  and  $h$ , and found, as expected, a high degree of response in  $h$  when changes were made to  $M$ , and vice versa. However, we found little effects on  $F$ . The lack of trade-off between  $M$  and  $F$  is likely the result of model assumptions about catch and biomass, specifically that we have absolute estimates of both (commercial catch is known with high certainty and  $q=1$  from 1988 to present).

Our tests confirmed a degree of confounding amongst these three parameters, although they do not allow us to confirm whether high  $M$  values accurately reflect the current productivity regime. An example of parameter response between  $h$  and  $M$  for the CC stock is presented in Figure 18. We will continue this work by exploring the effects of: (1) estimating time-invariant  $M$ , (2) constraining the year-



to-year rate of change in  $M$  (reducing the variance), (3) fixing  $h$  at 0.74 (as per Myers et al. 1999) and (4) estimating  $h$  across all stocks. Further results of these tests will help us with future development of a herring operating model for use in a management strategy evaluation.

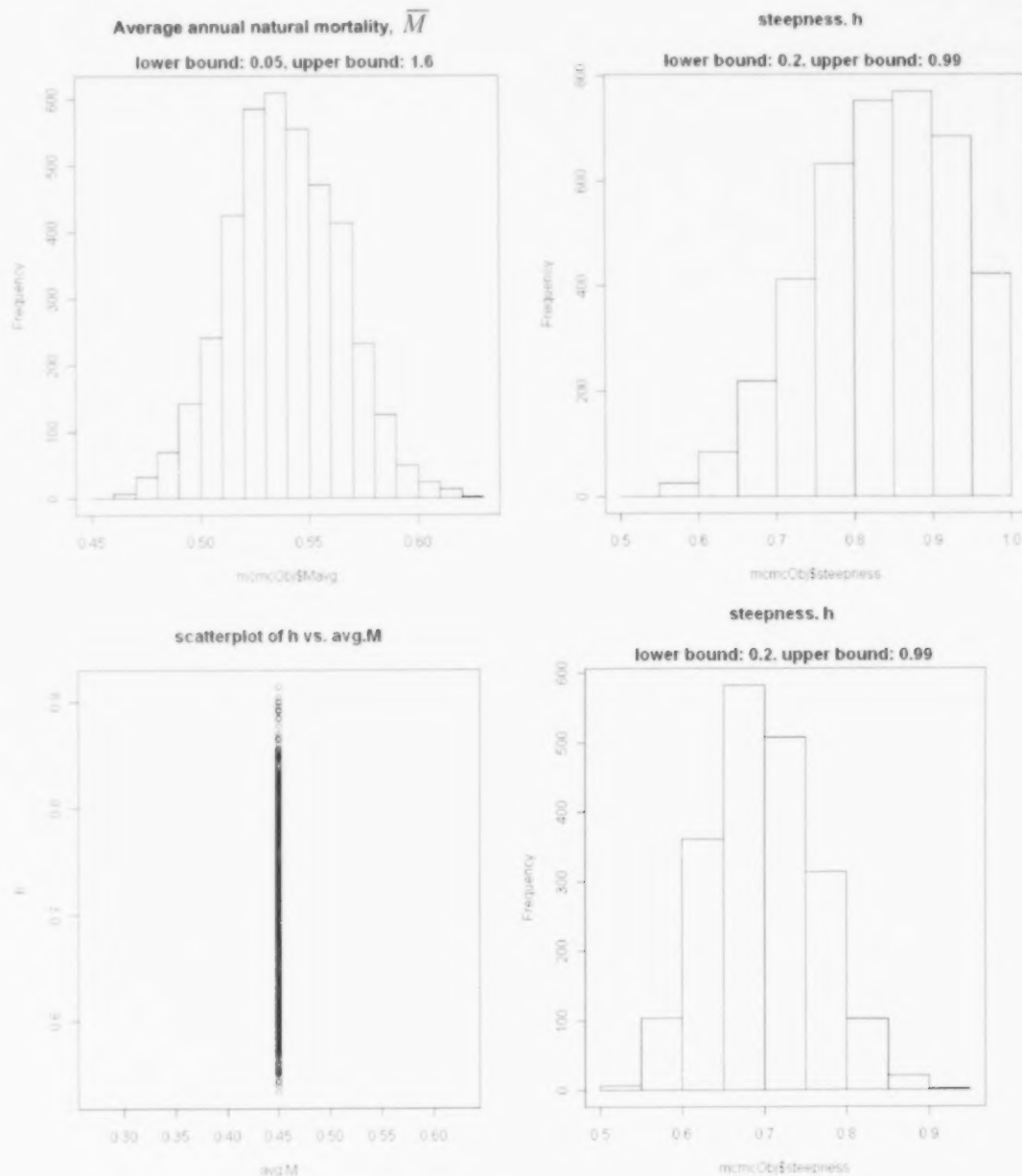


Figure 18. Distribution of steepness,  $h$ , under time-varying (top left) and fixed estimates of average annual natural mortality (bottom left,  $\bar{M}$ , where  $M$  is  $N \sim (0.45, 0.2)$ ).

### 5.1.8. Parameter estimation

Marginal posterior distributions are available for all parameters estimated using MCMC routines. We have included posterior distributions (Figure 19) and trace lines (Figure 20) for key model parameters and derived variables which are used for providing science advice on each stock. Median values of the marginal posterior distributions (vertical black dashed lines) are used in calculating pre-fishery forecast biomass and available catch, presented in Table 4.

Ideally, we like to see smooth posterior distributions, such as the posterior distributions for average recruitment and steepness for the WCVI stock. These posterior samples follow a normal distribution and it is clear that there is no interference of the parameter bounds during the parameter estimation procedure. In most cases, the MPD and median of the marginal posterior distributions are similar, as indicated by the high degree of overlap between the solid green and black dashed lines. The main exception to this statement is the CC stock. The posterior distribution for steepness for the CC stock indicates that the estimation procedure is constrained by the upper bound (i.e., 1.0). This problem is resolved if we fix  $M$  at 0.45, rather than include a time-varying natural mortality rate.

Model estimates of steepness (median of the posterior distribution) for all stocks are: QCI=0.74, PRD=0.64, CC=0.84, SOG=0.73 and WCVI=0.72. High steepness values infer high stock productivity and that recruitment is relatively invulnerable to the effects of fishing. At this point we are unable to determine whether  $h=0.84$  is biologically reasonable for the CC herring stock, or whether it is the result of parameter confounding mentioned in Section 5.1.7. However, one must also recognize that steepness bounds (0.2-1.0) are the natural bounds of the Beverton-Holt stock recruitment relationship, thus high density at the upper bound may not be an issue.

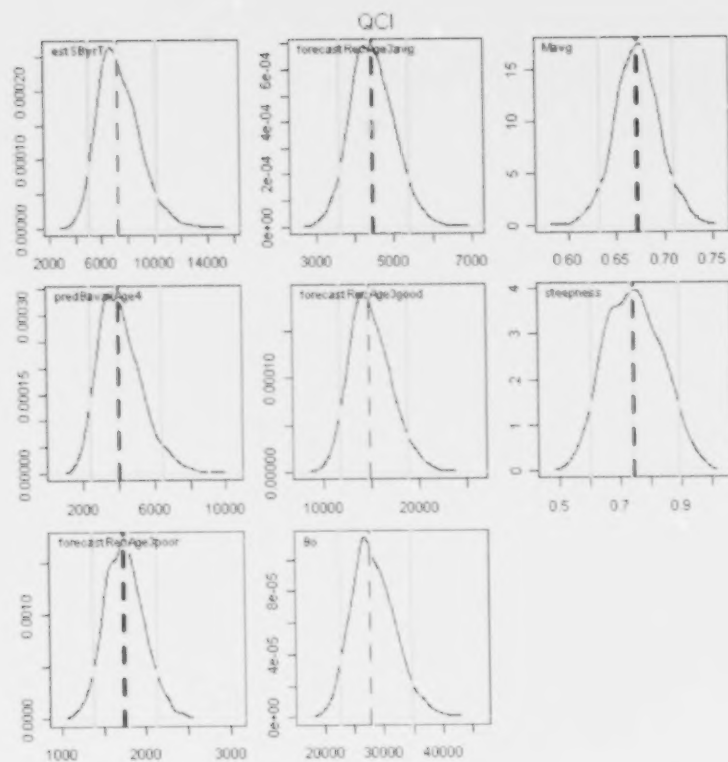


Fig 19. QCI

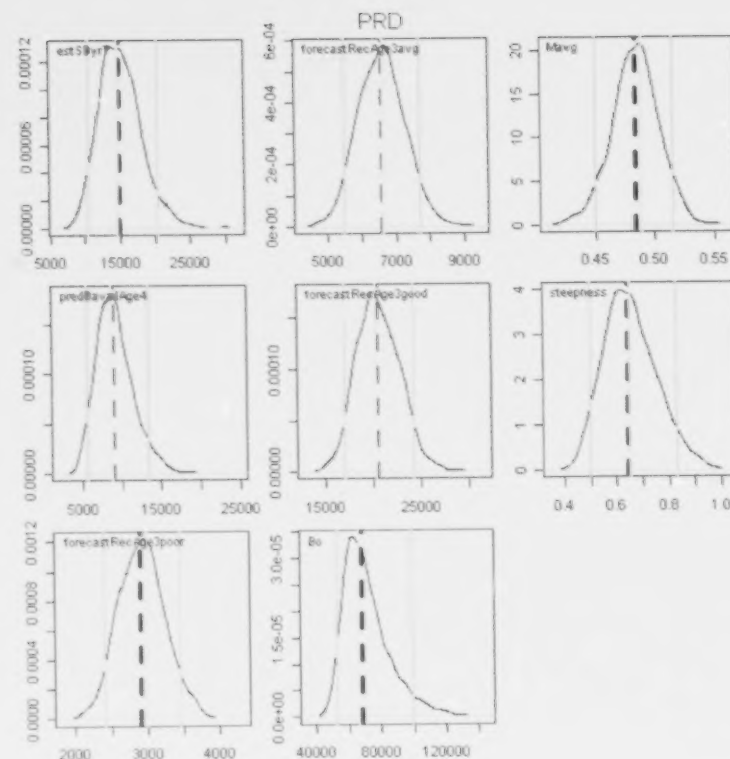


Fig 19. PRD

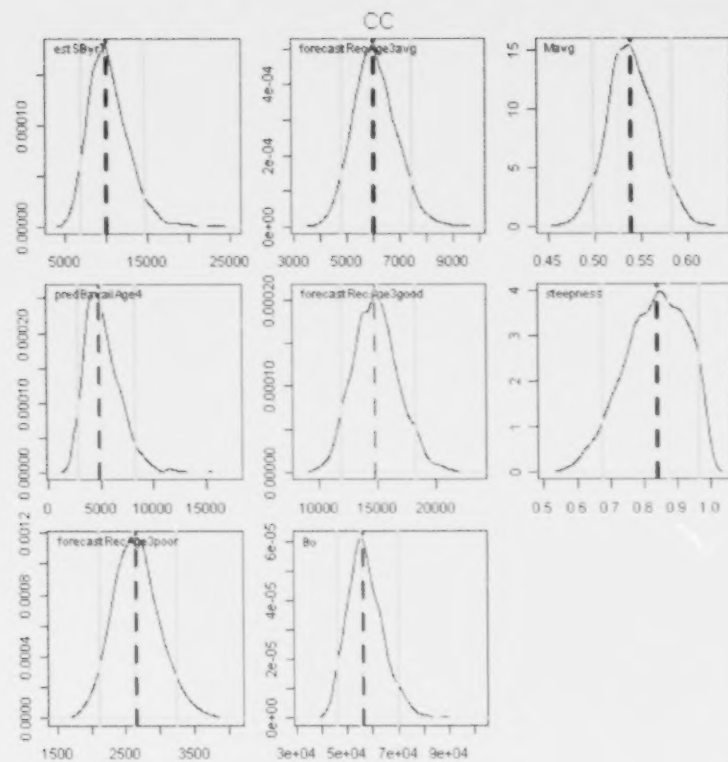


Fig 19. CC

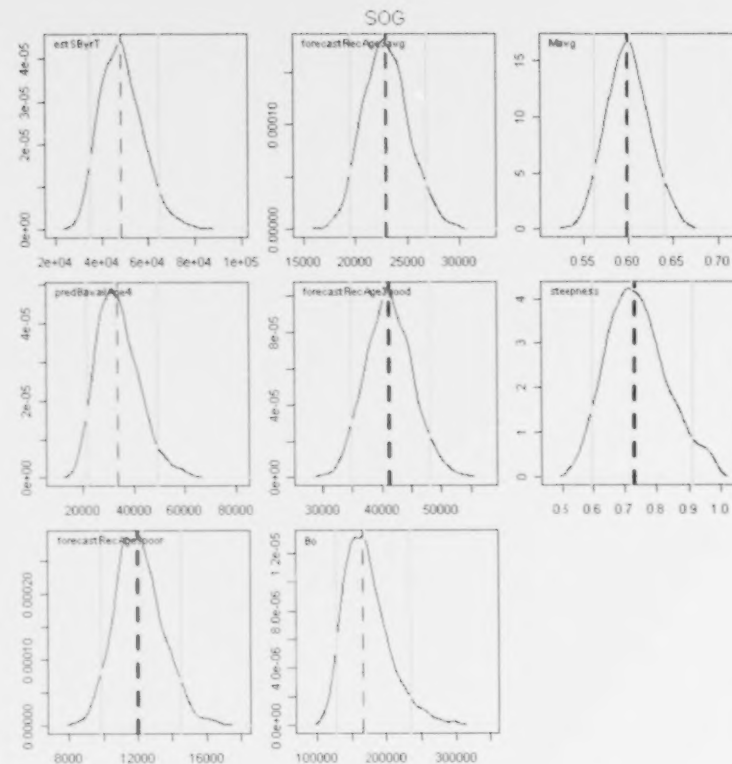


Fig 19. SOG

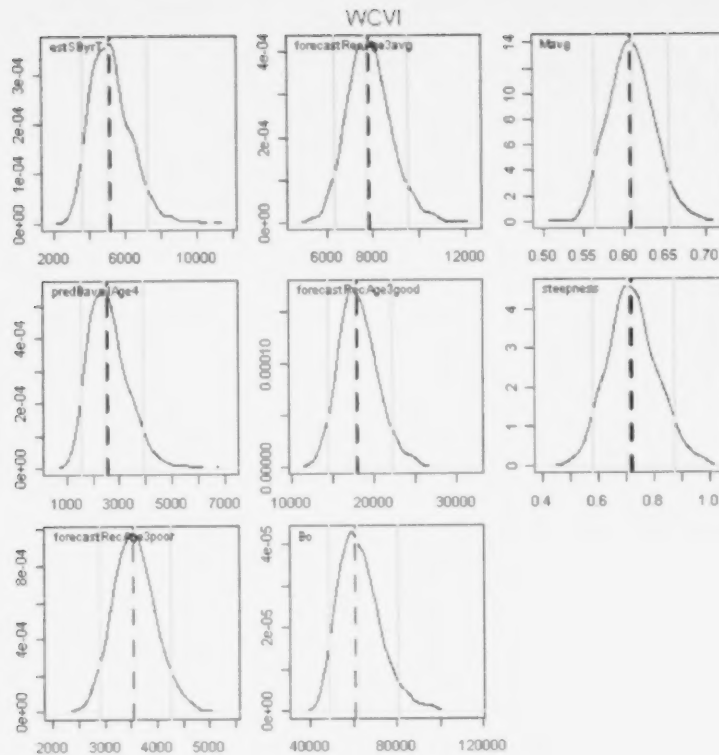


Fig 19. WCVI

Figure 19. Marginal posterior distributions for key parameters of the 2009 assessment, shown for the five major stock areas. Black trend lines outlines the marginal posterior distribution for each parameter, vertical black dashed lines represents median posterior values while solid green lines represent MPD estimates. Gray vertical lines denote the 5% and 95% quantiles of the posterior distribution. Estimated parameters include: unfished biomass ( $B_0$ ), average natural mortality ( $M_{avg}$ ), and steepness. The other five distributions are key derived variables used for providing science advice to management. These include: estimated spawning biomass in the final year ( $estSByr7$ ), predicted availability of age 4 and older fish (in biomass,  $predBavailAge4$ ), and forecast recruitment of age 3 fish under estimates of poor, average and good recruitment ( $forecastRecAge3poor$ ,  $forecastRecAge3avg$  and  $forecastRecAge3good$ ).

Model runs were examined for convergence through visual inspection of MCMC trace plots (Figure 20). For the QCI, CC and WCVI stocks, convergence was apparent for all parameters with a chain length of 2 million. For PRD and SOG stocks we found evidence of non-convergence in the estimation of steepness ( $h$ ) and unfished biomass ( $B_0$ ). In attempts to resolve these issues, we ran additional chains up to 20 million iterations. These extra long chains did improve the appearance of the trace plots, and it is likely that additional iterations, up to 50 million, would lead to convergence in all parameters. However, time did not permit these additional simulations.

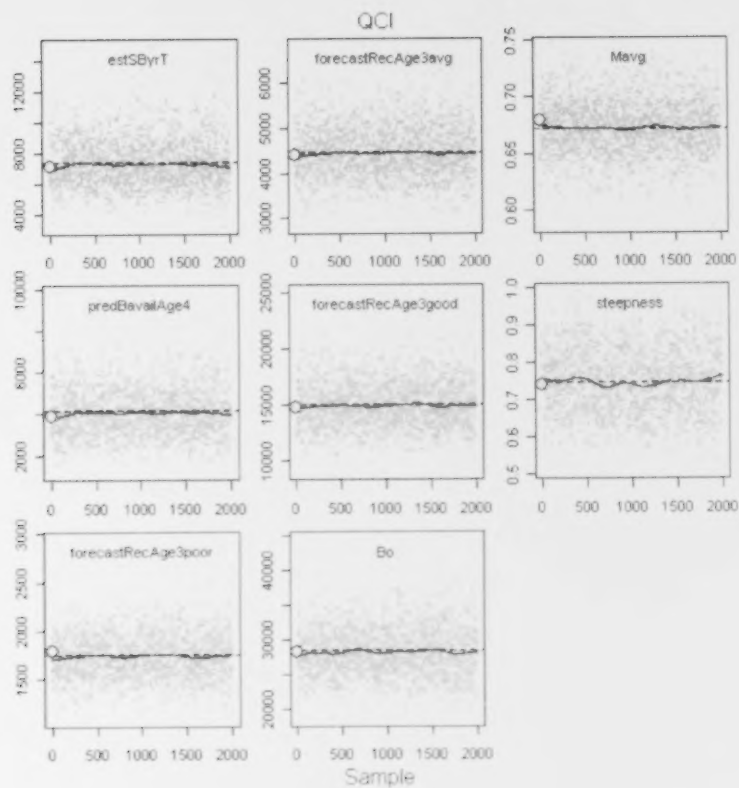


Fig 20. QCI

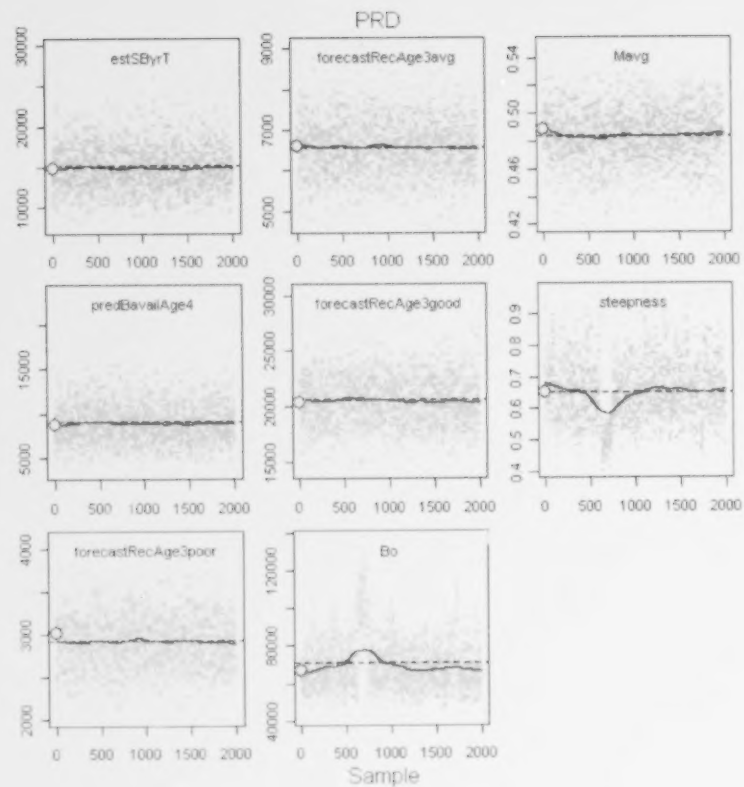


Fig 20. PRD

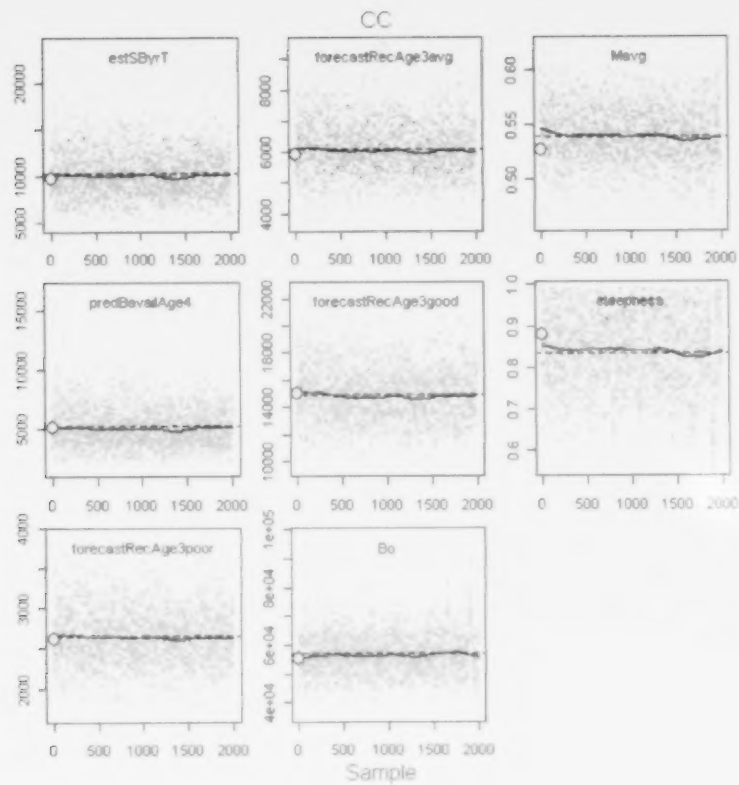


Fig 20. CC

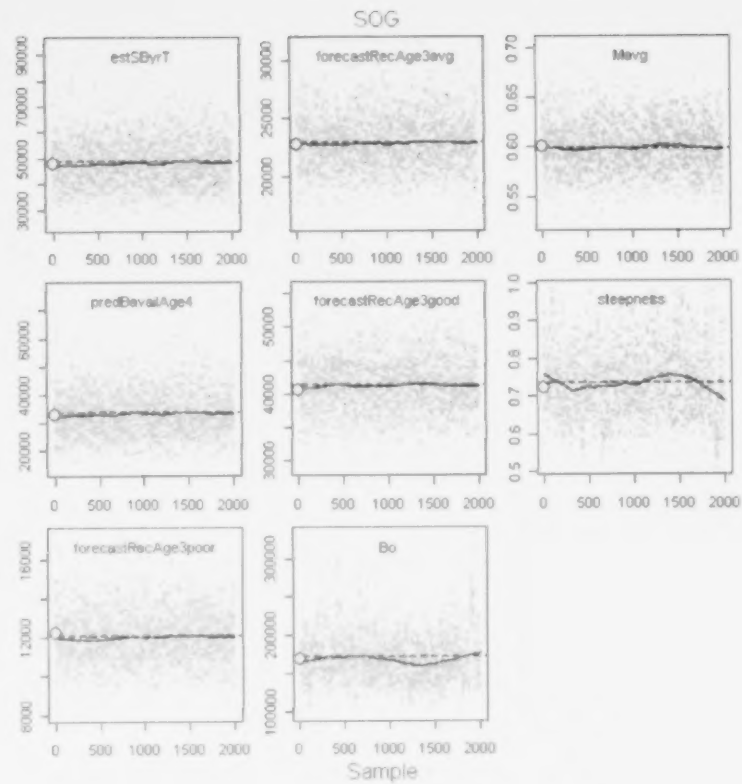


Fig 20. SOG



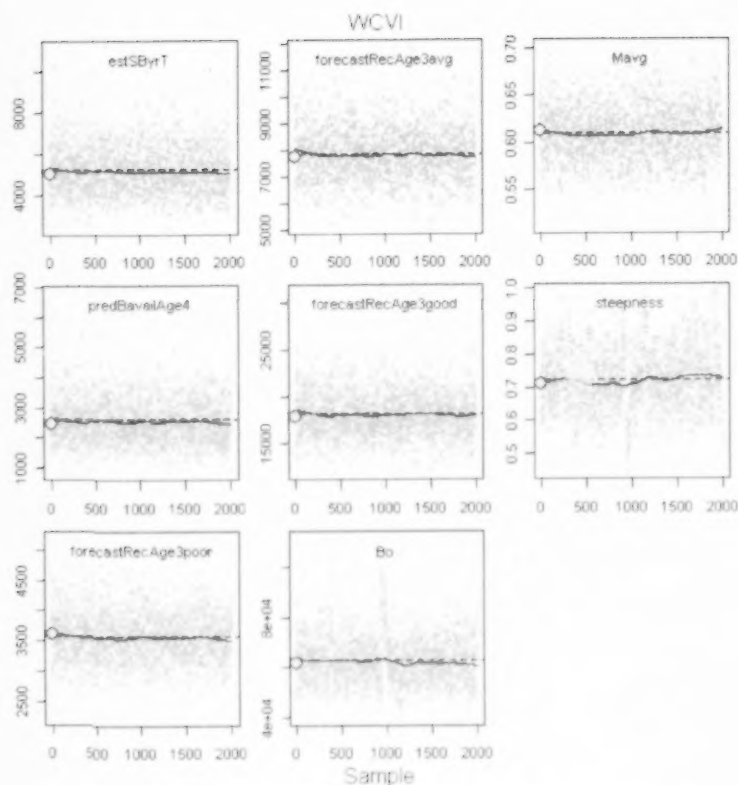


Fig 20. WCVI

Figure 20. MCMC trace plots for key parameters of the 2009 assessment, shown for the five major stock areas. Black trend lines were generated using a locally-weighted polynomial regression (lowess smoother) and reflect average behaviour across posterior samples. Green points represent MPD estimates, which also correspond to the MLE for each parameter. See Figure 19 caption for parameter and variable descriptions.

### 5.1.9. Retrospective analysis

A retrospective analysis was conducted for each of the major herring stocks to examine the sensitivity of pre-fishery biomass to the addition of new data (Figure 21). Only MPDs were estimated for these analyses. These figures show the pre-fishery biomass for each year since 1999, demonstrating the effect of additional data on model performance relative to the estimates from the stock trajectory in the final year. For QCI and WCVI stocks, incidences of over- and under-estimation of pre-fishery biomass occur with the same frequency, and thus appear to be unbiased. The PRD and CC stocks show a positive retrospective bias for most years of the analysis, while the SOG stock demonstrates a negative bias for years 1999-2002. In terms of precautionary fisheries management, a persistent positive bias warrants further investigation as it can lead to

the stock being subject to a higher harvest rate than is recommended under the herring harvest control rule. Although the cause of these biases is currently unknown, it should be noted that the magnitude of these retrospective biases is much smaller than has been previously observed, prior to the implementation of the HCAMv2 model (Haist and Schweigert 2006, Schweigert et al. 2009).

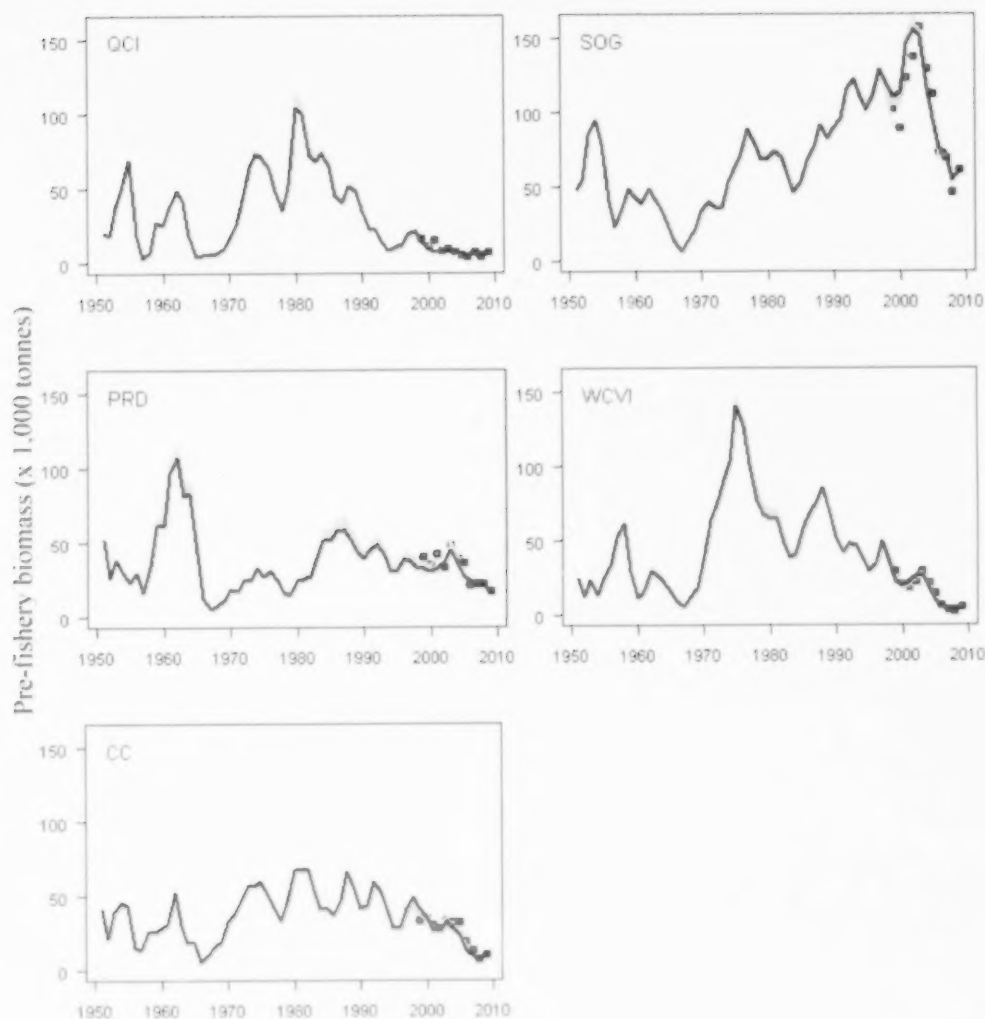


Figure 21. Retrospective maximum likelihood estimates of pre-fishery biomass for the five major stock areas (1999-2009). Black line and solid black circle represent the complete time series. Gray lines and gray filled circles denote terminal year estimates for the reconstruction.

## 5.2. Catch advice

Catch advice is provided in the form of a decision table, with pre-fishery biomass and available harvest presented for three recruitment scenarios: poor, average and good. Similar results were obtained using both estimation procedures, however, Table 4 includes only those calculated using median values of the marginal posterior distributions.

*Table 4. Estimated spawning stock biomass (SSB), pre-fishery forecasts and available harvest calculated using median values from the marginal posterior distributions for the major stock areas.*

	Pre-fishery Forecast Biomass						Available Harvest		
	2009 SSB	2010 age 4	Poor	Average	Good	Cutoff	Poor	Average	Good
QCI	7,172	4,013	5,750	8,447	18,810	10,700	0	0	3,762
PRD	14,866	8,909	11,829	15,499	29,366	12,100	0	3,100	5,873
CC	9,991	4,934	7,577	10,961	19,772	17,600	0	0	2,172
SOG	47,966	33,020	45,001	55,857	74,216	21,200	9,000	11,171	14,843
WCVI	5,112	2,506	6,063	10,333	20,490	18,800	0	0	1,690

Time series of model estimates of pre-fishery biomass are presented in Figure 22, and include comparisons of spawning biomass, spawn index and cutoff levels.

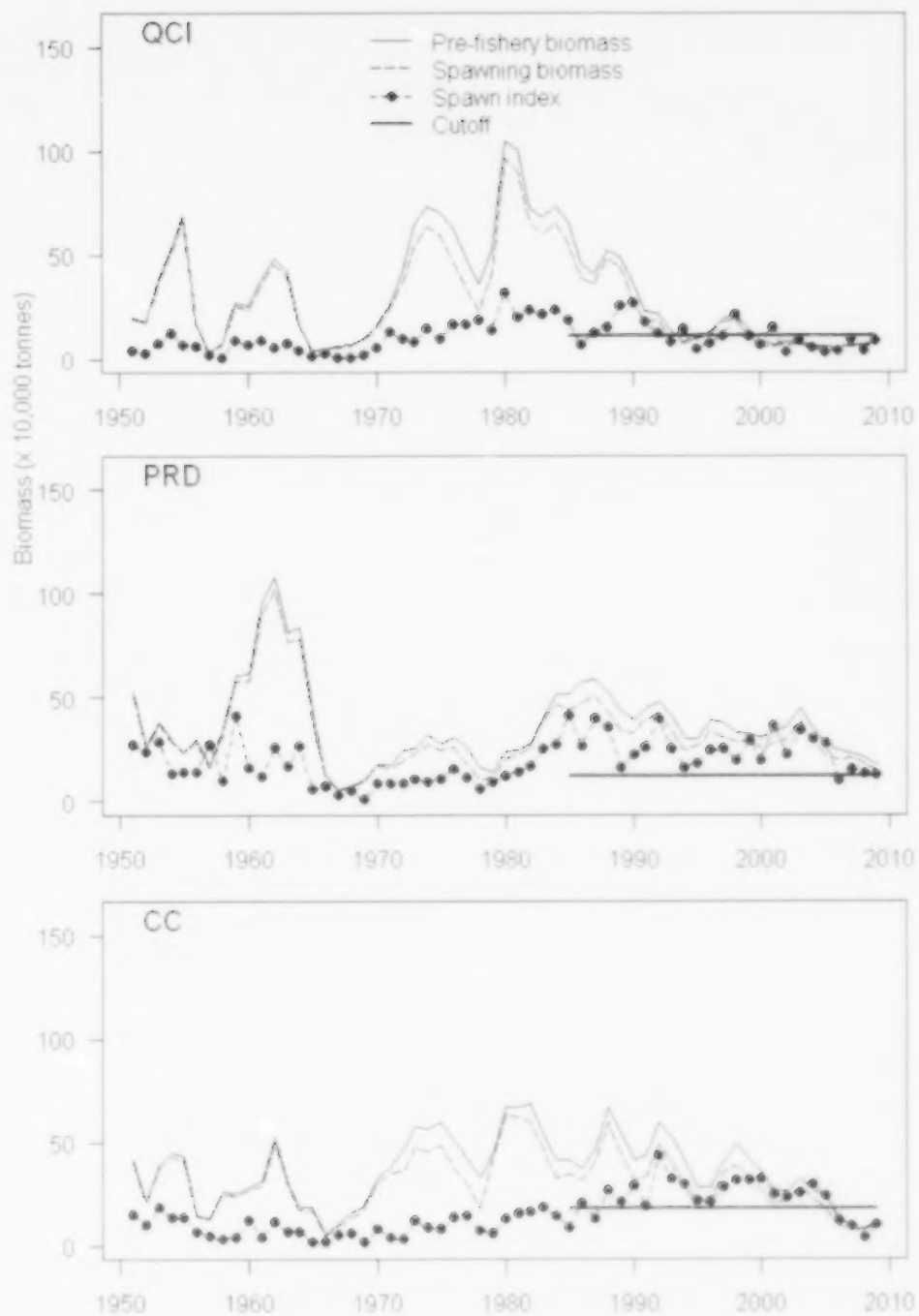


Fig 22.

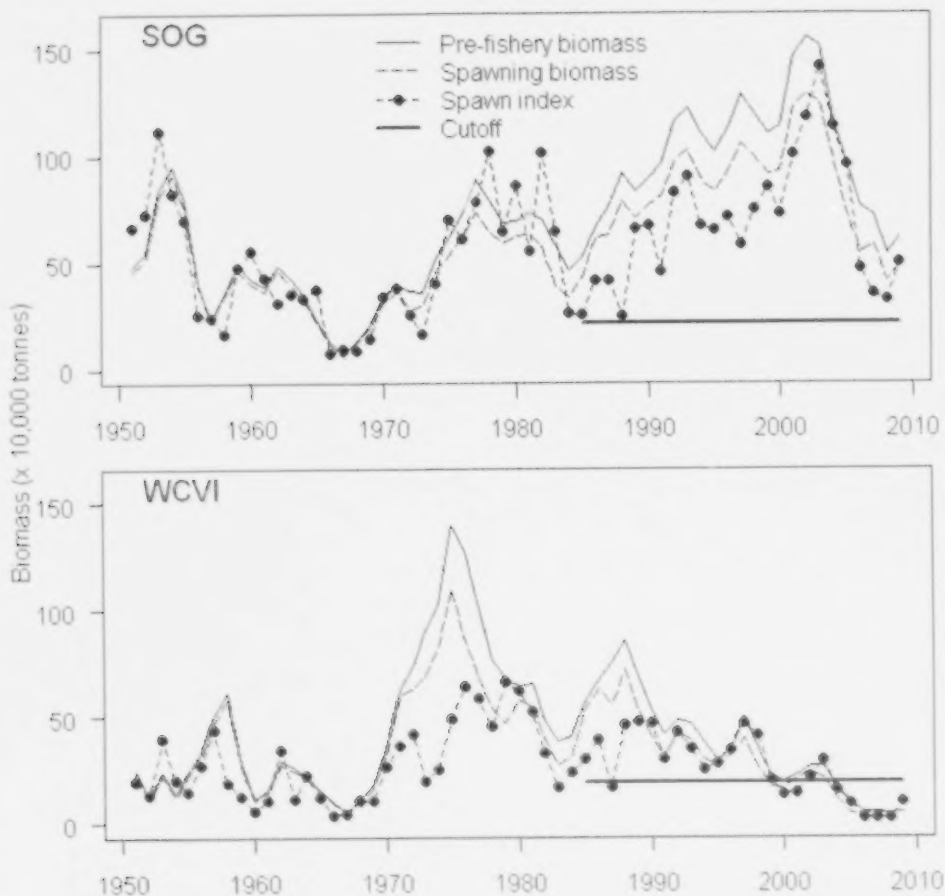


Figure 22. Estimates of pre-fishery stock biomass with comparisons to estimated spawning biomass, spawn index and harvest cutoff levels for all major stock areas.

## 6 Stock assessment for minor stock areas

### 6.1. Model estimates

Abundance estimates for the minor stock areas, Area 27 and Area 2W, were obtained using the HCAmV2 assessment model. Because of data limitations for these minor stocks, the time series of analysis was restricted to the period of 1978-2009. For the most part, the model is parameterized in the same way as was used for the major stock areas. However, there are a few minor differences which are described in Appendix B.

Model estimates of pre-fishery spawning biomass were determined assuming two spawn index proportionality coefficients ( $q$ ) for Area 27 and one  $q$  for Area 2W (same as the 2008 assessment). For Area 27,  $q_1 = 1.0699$  and  $q_2 = 1.0$  and for Area 2W-B,  $q = 0.6181$  (0.6589 for A2W-A). At first glance, Figure 23 indicates what appears to be an overestimation of pre-fishery biomass and spawning biomass for Area 2W (A2W-B, bottom panel), however we do not feel these are unrealistic as they appear to be the result of including additional ageing data in this year's assessment. For the purposes of comparison, we have included Area 2W results produced using the 2008 configuration of the HCAMv2 model (A2W-A).

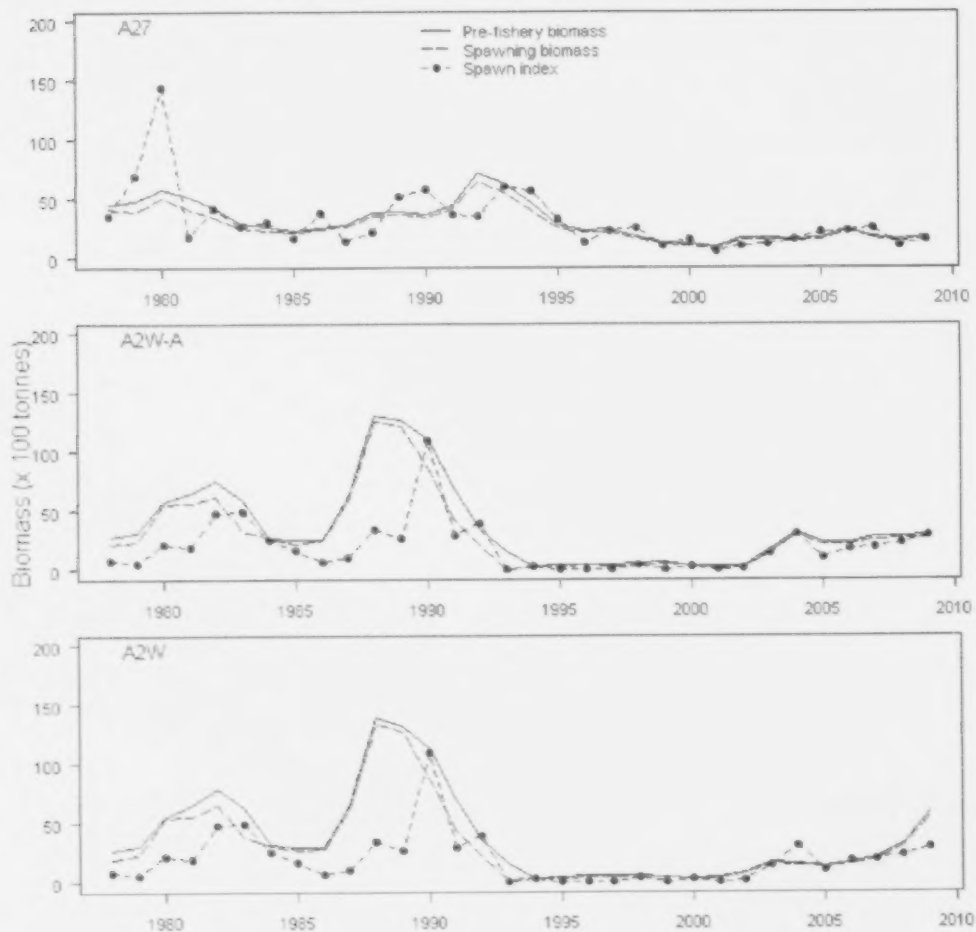


Figure 23. Estimates of pre-fishery spawning stock biomass, estimated spawning biomass and spawn index for the minor stock areas. The middle panel, A2W-A, was produced using the 2008 configuration of the HCAMv2 model (fewer ageing samples), while the bottom panel, A2W-B, was produced using the 2009 assessment model (includes all ageing samples).

### 6.1.1. Recruitment

Following the same approach used with the major stock areas, recruitment of age 3 fish is estimated as the number of age 3 fish recruited to the stock at the beginning of year  $t$ . Recruitment is categorized as poor, average or good, and model estimates of recruitment are calculated as the lower 33%, middle 33% and upper 33% of the number of age 3 fish over the entire time series. Numbers of recruits and the poor-average and average-good recruitment category divisions (0.33 and 0.66 quantiles) are presented for the minor stock areas in Figure 24. With the addition of each year of data, these category divisions change slightly to reflect our updated view of poor, average and good recruitment. Based on this year's information, Area 27 and Area 2W show good recruitment in 2009.

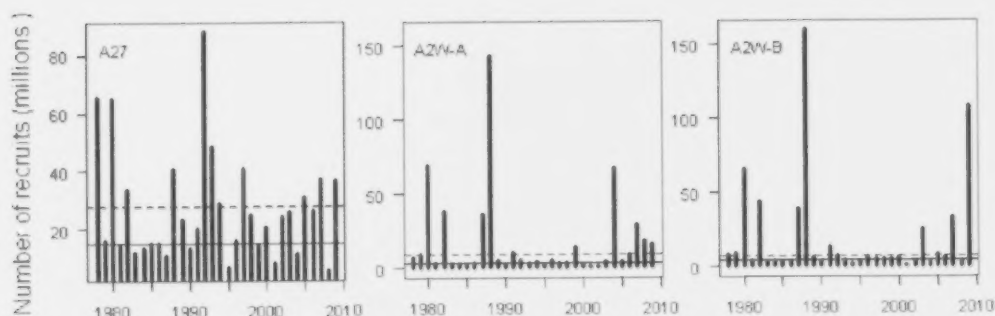


Figure 24. Estimated number of age 3 fish recruiting to the stock in the minor stock assessment areas. Model A (A2W-A, middle panel) and Model B (A2W-B, right-hand panel) estimates are presented for Area 2W. Upper dashed lines represent division between good and average categories of recruitment, lower solid lines represent division between average and poor recruitment. Divisions were calculated as the 0.33 and 0.66 quantiles of the historic numbers of age 3 fish across all years. Note range in y-axis differs between A27 and A2W.

### 6.2. Catch advice

Catch advice is provided in the form of a decision table, with pre-fishery biomass and available harvest presented for three recruitment scenarios: poor, average and good. Results presented in Table 5 are calculated using median values of the marginal posterior distributions. Cutoff values are not available for the minor stock areas and instead available harvest represents a 10% harvest rate. Results are presented for Area 27 and for Area 2W.



Table 5. Estimated spawning stock biomass (SSB), pre-fishery forecasts and available harvest calculated using median values from the posterior distributions for the minor stock areas.

	Pre-fishery Forecast Biomass						Available Harvest		
	2009 SSB	2010 age 4	Poor	Average	Good	Cutoff	Poor	Average <sup>1</sup>	Good
A27	1,627	723	1,000	1,347	2,108	NA	100	135	211
A2W-A	2,871	1,920	2,013	2,163	3,888	NA	201	216	389
A2W-B	5,695	3,885	4,000	4,125	5,938	NA	400	413	594

<sup>1</sup> Current decision rule: Assume average recruitment for all minor stock areas.

## 7 Outstanding issues

After completing this year's herring stock assessment, we feel there are a number of areas which require further investigations. Future research will:

1. Improve our understanding of the relationship between natural mortality and steepness in order to determine whether high observed values of  $M$  and  $h$  are biologically reasonable for the B.C. herring stock.
2. Explore additional methods of defining natural mortality, including: (1) estimating time-invariant  $M$ , (2) constraining the year-to-year rate of change in  $M$  (reducing the variance) and (3) fixing  $h$  at 0.74 (as per Myers et al. 1999).
3. Explore the impacts of estimating steepness across all stocks.
4. Compare gillnet and seine selectivity functions. Constrain logistic functions to remain at 1 once fully-selected age is reached. For example, assume all ages greater than age-8 are fully selected.

We feel these areas of research are important and will help us with future development of a herring operating model for use in a management strategy evaluation.

## Acknowledgements

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## Appendices

### A Input data

Table 1.1. Age composition and catch by season, fishery and gear type for the Queen Charlotte Islands stock assessment region. Percentages represent a combination of samples taken from commercial fisheries and pre-fishery charters. Age-9++ represents the plus group of ages.

Season	Gear	Fishery	PERCENT AT AGE										Mean Weight	Number Aged	CATCH	
			0+	1+	2+	3+	4+	5+	6+	7+	8+	9++			(tonnes)	(millions)
19501	Seine	Jan-Apr	0.00	0.07	15.31	52.91	15.31	11.52	4.20	0.61	0.07	0.00	89.7	1.476	2.847	31.744
19512	Seine	Jan-Apr	1.92	24.77	20.96	29.67	17.98	3.71	0.93	0.07	0.00	0.00	78.4	2.251	10.147	122.347
19534	Seine	Jan-Apr	0.06	2.90	29.02	21.28	33.66	10.19	1.93	0.71	0.19	0.06	77.1	0.4	1.796	23.168
19545	Seine	Jan-Apr	0.00	0.74	14.08	39.42	18.06	14.85	4.37	0.29	0.10	0.10	94.1	0.4	498	5.294
19556	Seine	Jan-Apr	0.00	0.15	16.02	9.64	62.17	8.38	2.74	0.74	0.00	0.15	118.2	1.348	77.461	855.182
19567	Seine	Jan-Apr	0.07	20.74	24.63	15.96	9.38	26.31	2.36	0.44	0.11	0.00	102.9	4.423	21.803	209.492
19578	Seine	Oct-Dec	0.00	81.98	16.58	1.26	0.18	0.14	0.14	0.00	0.00	0.00	52.1	2.769	721	13.844
19589	Seine	Jan-Apr	0.00	1.05	63.16	28.42	7.37	0.00	0.00	0.00	0.00	0.00	92.8	95	6.828	73.560
19601	Seine	Jan-Apr	0.00	4.21	32.63	36.00	24.84	1.26	0.42	0.21	0.42	0.00	97.7	0.4	576	5.901
19612	Seine	Jan-Apr	0.00	2.57	38.97	44.12	5.88	7.35	0.74	0.37	0.00	0.00	114.0	272	7.632	66.952
19623	Seine	Jan-Apr	0.00	0.37	50.00	27.11	18.16	2.11	1.99	0.00	0.12	0.12	109.5	804	14.705	134.232
19634	Seine	Jan-Apr	0.00	1.02	15.92	60.00	16.53	5.31	1.22	0.00	0.00	0.00	113.9	490	28.600	251.046
	Seine	May	0.00	1.02	15.92	60.00	16.53	5.31	1.22	0.00	0.00	0.00	113.9	490	127	1.113
	Trawl	Jan-Apr	0.00	1.02	15.92	60.00	16.53	5.31	1.22	0.00	0.00	0.00	113.9	490	46	0.401
19645	Seine	Jan-Apr	0.00	1.71	82.31	10.25	3.63	1.34	0.55	0.20	0.00	0.00	101.5	1.019	35.304	348.556
	Seine	May	0.00	1.67	81.75	10.30	4.02	1.47	0.59	0.20	0.00	0.00	102.0	1.019	145	1.419
19656	Seine	Jan-Apr	0.00	18.36	32.77	16.38	10.40	7.45	5.89	4.92	2.07	1.75	130.7	0.4	213	21.016
19667	Seine	Jan-Apr	0.00	0.88	67.25	26.49	2.65	7.72	0.00	0.00	0.00	0.00	91.0	0.4	213	1.883
19678	Seine	Jan-Apr	0.00	29.95	50.57	17.23	2.25	0.00	0.00	0.00	0.00	0.00	113.9	0.4	80	0.843
19701	Seine	Jan-Apr	0.00	6.50	50.40	29.30	8.00	4.30	0.80	0.50	0.20	0.00	118.1	0.4	102	0.861
19712	Seine	Jan-Apr	0.00	3.59	34.24	40.98	12.30	5.57	2.14	0.77	0.35	0.06	142.1	1.184	3.972	27.954
19723	Seine	Jan-Apr	0.00	0.20	32.91	18.91	32.99	11.77	2.10	1.13	0.00	0.00	140.7	1.726	7.520	49.735
19734	Seine	Jan-Apr	0.00	0.12	27.40	41.39	17.67	10.64	2.32	0.40	0.06	0.00	126.8	1.215	6.191	47.881
	Gillnet	Jan-Apr	0.00	0.00	5.73	48.41	25.48	16.56	3.18	0.00	0.00	0.64	153.8	157	127	0.824
19745	Seine	Jan-Apr	0.00	0.62	27.82	36.04	24.53	8.53	1.94	0.40	0.12	0.00	132.8	6.010	7.602	60.181
	Seine	May	0.00	0.13	33.28	45.41	13.55	5.29	1.72	0.46	0.17	0.00	116.3	3.026	17	0.147
	Gillnet	Jan-Apr	0.00	0.00	0.00	22.50	40.00	30.00	5.00	2.50	0.00	0.00	169.3	40	105	0.619
19756	Seine	Jan-Apr	0.00	0.30	2.98	44.51	31.53	15.24	4.61	0.76	0.06	0.00	155.4	4.055	11.939	82.499
	Seine	May	0.00	0.44	2.81	36.87	29.25	23.18	6.41	0.96	0.07	0.00	151.8	4.055	374	2.466
	Gillnet	Jan-Apr	0.00	0.00	0.00	0.75	21.80	60.90	14.29	2.26	0.00	0.00	196.2	133	9.186	9.186
19767	Seine	Jan-Apr	0.00	0.05	18.42	9.26	36.68	22.74	9.92	2.64	0.31	0.00	159.1	3.178	11.125	73.628
	Seine	May	0.00	0.09	19.67	8.12	29.70	22.91	14.66	4.44	0.41	0.00	157.1	3.178	21	0.132
	Gillnet	Jan-Apr	0.00	0.00	0.00	2.53	16.61	39.71	27.08	11.55	2.17	0.36	196.6	2.77	1.489	7.575
19778	Seine	Jan-Apr	0.00	0.16	22.75	17.10	11.34	33.12	13.29	2.03	0.17	0.05	146.4	1.172	9.172	82.947
	Gillnet	Jan-Apr	0.00	0.00	0.00	4.17	11.81	20.14	38.89	20.14	4.17	0.69	196.9	144	2.553	12.967
19789	Seine	Oct-Dec	0.00	6.22	4.91	32.53	18.23	20.31	14.19	3.06	0.44	0.11	149.9	916	50	0.336
	Seine	Jan-Apr	0.00	7.06	5.39	32.35	18.20	20.40	12.45	3.08	0.51	0.13	148.9	779	5.817	39.078
	Gillnet	Jan-Apr	0.00	0.00	0.00	28.24	25.88	27.06	15.29	3.53	0.00	0.00	160.1	170	2.086	13.028
19790	Seine	Jan-Apr	0.00	0.69	83.10	4.49	5.44	2.58	1.79	1.22	0.60	0.09	97.1	2.966	2.106	22.050
	Gillnet	Jan-Apr	0.00	0.00	0.00	6.50	4.56	44.47	19.36	19.58	4.20	1.34	157.6	518	1.210	7.739
19801	Seine	Jan-Apr	0.00	0.42	3.05	85.37	5.13	3.08	1.92	0.68	0.21	0.14	116.3	5.551	3.888	32.912
	Seine	May	0.00	1.33	3.92	88.65	2.94	1.73	0.69	0.35	0.23	0.17	112.7	1.735	39	0.342
	Gillnet	Jan-Apr	0.00	0.00	0.30	72.00	6.55	9.84	5.86	2.84	0.60	0.00	141.9	790	1.705	11.930
19812	Seine	Jan-Apr	0.00	0.45	3.26	3.50	87.61	2.19	1.34	0.95	0.57	0.12	127.2	3.526	2.353	18.420
	Seine	May	0.00	0.85	4.68	4.48	84.32	2.47	1.53	0.99	0.54	0.14	128.0	3.526	18	0.138
	Gillnet	Jan-Apr	0.00	0.00	0.21	3.35	89.10	3.35	2.31	1.05	0.42	0.21	141.9	477	1.407	9.918
19823	Seine	Jan-Apr	0.00	4.14	4.21	3.02	5.75	77.05	3.65	1.33	0.70	0.14	148.7	1.425	4.601	30.942
	Seine	May	0.00	4.88	5.23	3.51	6.86	72.87	3.91	1.58	0.91	0.25	146.9	1.968	67	0.457
	Gillnet	Jan-Apr	0.00	0.00	0.00	1.19	2.38	90.32	2.72	2.38	0.51	0.51	158.5	589	929	5.860
19834	Seine	Jan-Apr	0.00	2.09	36.57	4.17	2.64	9.56	43.33	1.11	0.35	0.17	126.1	3.484	4.054	31.997
	Seine	May	0.00	2.70	36.39	4.54	2.87	10.10	41.76	1.12	0.34	0.17	125.5	3.484	58	0.459
	Gillnet	Jan-Apr	0.00	0.00	0.21	1.28	4.60	8.95	80.05	1.79	0.26	0.26	154.6	349	535	3.459
19845	Seine	Jan-Apr	0.00	0.12	8.63	25.14	3.52	3.93	12.79	45.24	0.53	0.10	146.4	3.099	4.581	27.888
	Seine	May	0.00	0.10	8.15	24.49	3.51	3.95	12.94	46.22	0.54	0.10	165.5	2.025	35	0.209
19856	Gillnet	Jan-Apr	0.00	0.00	0.30	24.48	2.90	4.56	12.45	46.89	0.41	0.00	155.0	2.41	1.493	9.932
	Seine	Jan-Apr	0.00	0.31	2.80	10.56	37.58	8.70	9.63	11.18	17.70	1.55	163.5	322	2.613	15.278
	Gillnet	Jan-Apr	0.00	0.00	0.00	12.73	53.42	4.04	5.28	9.01	15.22	0.31	159.7	322	0	0.000
19867	Seine	Jan-Apr	0.00	1.78	9.60	4.90	24.93	38.44	3.88	4.36	5.86	6.24	158.6	2.916	2.028	12.787
	Seine	May	0.00	1.74	10.42	5.85	24.35	37.76	3.84	4.33	5.79	5.91	157.2	3.281	33	0.210
19878	Seine	Jan-Apr	0.00	3.64	51.01	7.52	4.77	11.75	14.86	1.37	1.67	3.40	123.6	1.676	0	0.000
	Seine	May	0.00	1.34	41.98	5.34	3.24	14.50	22.71	1.91	1.72	7.25	136.5	524	32	0.232
	Trawl	Jan-Apr	0.00	1.33	68.11	11.63	1.66	6.98	6.64	1.33	1.66	0.66	105.4	301	0	0.000
19889	Seine	Jan-Apr	0.00	3.43	5.12	85.99	3.74	0.18	0.77	0.47	0.08	0.22	119.2	2.996	1.449	11.972
	Seine	May	0.00	1.27	31.75	45.90	4.03	2.55	7.00	4.81	1.06	1.63	117.4	1.414	13	0.108
19890	Seine	Jan-Apr	0.00	0.14	10.61	6.53	78.55	4.43	0.33	0.85	0.34	0.23	133.9	4.769	5.542	39.649
	Gillnet	Jan-Apr	0.00	0.00	0.51	8.18	44.50	9.97	8.44	17.39	8.44	2.56	149.6	391	1.170	7.821
19901	Seine	Jan-Apr	0.00	5.60	4.25	10.74	33.21	33.99	3.68	2.00	4.70	1.84	127.8	2.448	3.899	30.506
	Trawl	Jan-Apr	0.00	1.06	4.26	8.51	21.28	46.81	4.25	6.38	4.26	3.19	143.0	94	0	0.000
	Gillnet	Jan-Apr	0.00	0.00	0.00	2.27	22.44	43.47	9.66	7.10	10.23	4.83	151.9	352	543	3.576
19912	Seine	Jan-Apr	0.00	1.05	30.50	4.25	8.27	4.46	48.40	2.42	0.14	0.52	143.2	3.228	2.524	16.695
	Trawl	Jan-Apr	0.00	1.08	54.84	9.68	2.15	15.05	11.83	3.23	2.15	0.00	115.6	93	0	0.000
19923	Seine	Jan-Apr	0.00	0.04	2.79	67.33	4.25	4.6								

Table 1.1. Age composition and catch by season, fishery and gear type for the Queen Charlotte Islands stock assessment region. Percentages represent a combination of samples taken from commercial fisheries and pre-fishery charters. Age-9++ represents the plus group of ages.

Season	Gear	Fishery	PERCENT AT AGE										Mean Weight	Number Aged	CATCH	
			0+	1+	2+	3+	4+	5+	6+	7+	8+	9++			(tonnes)	(millions)
19967	Seine	Jan-Apr	0.00	22.64	26.17	33.41	5.23	1.52	4.44	5.36	0.85	0.37	97.5	1.643	0	0.000 -
19978	Seine	Jan-Apr	0.00	0.23	55.83	27.55	10.64	2.70	0.51	1.11	1.04	0.39	86.8	2.327	2.093	24.012
19989	Seine	Jan-Apr	0.00	3.71	2.16	65.00	16.83	8.03	2.78	0.67	0.41	0.41	105.9	1.943	2.500	23.604
	Gillnet	Jan-Apr	0.00	0.00	0.67	30.78	22.80	29.12	9.98	2.66	1.33	2.66	131.4	601	1.000	7.609
19990	Seine	Jan-Apr	0.00	3.71	17.36	3.72	60.60	8.26	5.19	0.39	0.61	0.16	108.4	2.057	1.765	16.491
20001	Seine	Jan-Apr	0.00	15.26	31.65	22.32	5.06	20.92	3.05	1.39	0.26	0.09	97.0	1.147	0	0.000 -
20012	Seine	Jan-Apr	0.00	20.84	22.90	25.47	12.99	3.11	12.83	1.36	0.43	0.08	93.6	2.572	706	7.544
20023	Seine	Jan-Apr	0.00	0.08	68.16	18.33	6.43	3.24	1.13	2.10	0.40	0.12	96.7	2.472	0	0.000 -
20034	Seine	Jan-Apr	0.00	29.35	2.37	50.65	8.76	4.02	2.60	1.42	0.59	0.24	91.5	845	0	0.000 -
20045	Seine	Jan-Apr	0.00	1.30	46.29	15.66	28.57	3.90	2.37	1.22	0.46	0.23	93.9	1.309	0	0.000 -
20056	Seine	Jan-Apr	0.00	19.07	10.10	42.78	9.40	15.15	2.61	0.42	0.00	0.28	83.3	713	0	0.000 -
20067	Seine	Jan-Apr	0.00	1.10	45.24	14.29	20.88	5.86	10.26	2.20	0.18	0.00	93.5	546	0	0.000 -
20078	Seine	Jan-Apr	0.00	9.35	7.39	63.37	7.61	8.59	1.85	1.63	0.00	0.22	87.5	920	0	0.000 -
20089	Seine	Jan-Apr	0.00	0.10	64.31	7.58	22.13	1.99	2.89	0.40	0.50	0.10	79.0	1.003	0	0.000 -

NOTE: \* No biosample data available. Age composition and mean weight assigned from published reports.  
 \* Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods, by gear type.  
 - No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter.

Table 1.2. Age composition and catch by season, fishery and gear type for the Prince Rupert District stock assessment region. Percentages represent a combination of samples taken from commercial fisheries and pre-fishery charters. Age-9+ represents the plus group of ages.

Season	Gear	Fishery	PERCENT AT AGE										Mean Weight	Number Aged	CATCH		
			0+	1+	2+	3+	4+	5+	6+	7+	8+	9+			(tonnes)	(millions)	
19501	Seine	Oct-Dec	0.03	5.19	18.96	57.83	10.05	5.42	2.27	0.20	0.06	0.00	91.5	3,524	27,192	297,109	
	Seine	Jan-Apr	0.09	1.72	15.86	60.43	11.38	6.21	3.79	0.43	0.00	0.09	95.8	1,160	18,674	195,022	
	Seine	Oct-Dec	0.09	5.32	9.32	33.19	45.08	5.66	0.91	0.40	0.03	0.00	121.7	3,498	42,613	350,112	
19512	Seine	Jan-Apr	0.00	3.96	8.08	34.32	45.41	6.84	1.19	0.16	0.04	0.00	115.7	2,427	9,650	83,415	
	Seine	May	0.05	4.78	8.81	33.65	45.22	6.14	1.03	0.30	0.03	0.00	119.2	5,925	116	0,976	
	Seine	Oct-Dec	0.00	1.46	38.05	28.90	26.40	4.99	0.21	0.00	0.00	0.00	114.7	481	401	3,491	
19523	Seine	Jan-Apr	0.00	1.07	38.17	20.04	24.95	14.29	1.39	0.11	0.00	0.00	107.7	938	1,465	13,601	
	Seine	Oct-Dec	0.00	0.38	22.98	31.95	27.13	14.48	2.52	0.56	0.01	0.00	114.3	2,138	26,692	232,215	
	Seine	Jan-Apr	0.00	8.88	47.88	19.11	13.51	6.76	3.28	0.58	0.00	0.00	83.9	518	584	6,969	
19545	Seine	Jan-Apr	0.00	2.25	4.08	70.30	15.80	6.01	1.34	0.22	0.00	0.00	105.2	1,131	17,806	167,544	
19556	Seine	Oct-Dec	0.00	10.04	58.11	9.51	18.95	2.55	0.53	0.18	0.12	0.00	83.6	1,683	1,602	19,164	
	Seine	Jan-Apr	0.00	8.99	99.62	9.14	18.79	2.65	0.66	0.07	0.07	0.00	84.6	1,357	8,580	101,455	
	Seine	Oct-Dec	0.00	18.02	19.80	35.57	12.24	13.25	0.90	0.22	0.00	0.00	93.8	3,172	820	9,056	
19567	Seine	Jan-Apr	0.00	3.83	19.26	42.33	13.46	19.05	1.61	0.41	0.05	0.00	104.8	2,784	19,753	182,450	
	Seine	May	0.00	0.00	7.11	44.95	37.16	9.17	1.38	0.23	0.00	0.00	106.7	436	7,461	69,921	
	Trawl	Jan-Apr	0.00	4.08	21.43	52.04	12.24	10.20	0.00	0.00	0.00	0.00	88.3	98	0	0,000	
19578	Seine	Oct-Dec	0.00	58.55	24.14	6.24	7.24	0.80	3.02	0.00	0.00	0.00	62.7	497	1,270	20,260	
	Seine	Jan-Apr	0.00	58.55	24.14	6.24	7.24	0.80	3.02	0.00	0.00	0.00	62.7	497	667	10,540	
	Seine	May	0.00	58.55	24.14	6.24	7.24	0.80	3.02	0.00	0.00	0.00	62.7	497	2,586	41,259	
19589	Seine	Oct-Dec	0.00	1.64	62.11	19.52	5.96	7.16	2.05	1.54	0.01	0.00	98.0	1,592	1,629	16,406	
	Seine	Jan-Apr	0.00	2.88	61.03	19.34	5.06	7.96	1.81	1.85	0.06	0.00	97.5	1,454	5,629	57,722	
	Seine	May	0.00	1.17	62.96	19.29	6.19	6.74	2.21	1.44	0.56	0.00	98.7	1,592	2,899	29,047	
19590	Trawl	Jan-Apr	0.00	3.39	58.98	20.35	5.15	8.73	1.44	1.88	0.06	0.00	97.5	1,592	96	0,674	
	Seine	Oct-Dec	0.00	62.74	8.21	20.55	5.57	1.83	1.10	0.08	0.12	0.00	64.7	1,549	3,125	49,715	
	Seine	Jan-Apr	0.00	66.74	7.43	18.52	4.46	1.48	0.94	0.22	0.22	0.00	61.5	1,617	12,513	218,740	
	Seine	May	0.00	5.00	3.26	51.30	20.22	10.65	7.39	1.96	0.22	0.00	115.5	460	2,297	19,897	
	Trawl	Oct-Dec	0.00	59.38	7.49	23.25	6.10	2.21	1.17	0.22	0.19	0.00	64.7	3,166	72	1,110	
	Trawl	Jan-Apr	0.00	59.38	7.49	23.25	6.10	2.21	1.17	0.22	0.19	0.00	64.7	3,166	468	7,238	
19601	Seine	Oct-Dec	0.00	13.33	69.22	4.76	9.50	2.44	0.44	0.25	0.06	0.00	80.6	1,729	14,879	183,842	
	Seine	Jan-Apr	0.00	8.10	60.17	6.91	18.06	4.38	1.74	0.43	0.20	0.00	93.8	2,174	24,244	278,908	
	Seine	May	0.00	10.08	59.51	7.23	17.13	4.07	1.43	0.42	0.13	0.00	93.9	3,903	350	4,012	
19612	Trawl	Jan-Apr	0.00	10.25	60.16	7.07	16.63	3.97	1.38	0.41	0.13	0.00	86.7	3,903	3,273	37,756	
	Seine	Oct-Dec	0.00	6.70	32.01	38.46	7.44	11.41	2.23	0.74	0.74	0.25	106.6	403	633	5,936	
	Seine	Jan-Apr	0.00	6.70	32.01	38.46	7.44	11.41	2.23	0.74	0.74	0.25	106.6	403	25,352	237,877	
	Seine	May	0.00	6.70	32.01	38.46	7.44	11.41	2.23	0.74	0.74	0.25	106.6	403	346	3,243	
	Trawl	Oct-Dec	0.00	6.05	30.85	38.31	7.66	11.69	3.43	0.60	1.01	0.40	109.0	496	296	2,714	
	Trawl	Jan-Apr	0.00	6.05	30.85	38.31	7.66	11.69	3.43	0.60	1.01	0.40	109.0	496	1,033	9,474	
19623	Seine	Oct-Dec	0.00	76.33	15.42	4.46	3.10	0.28	0.35	0.06	0.00	0.00	55.5	1,267	9,769	199,178	
	Seine	Jan-Apr	0.00	38.55	15.20	21.58	17.43	3.27	3.61	0.21	0.06	0.10	96.9	1,921	29,142	350,800	
	Seine	May	0.00	60.74	16.33	12.62	7.12	1.42	1.69	0.01	0.00	0.07	74.6	3,188	736	11,819	
	Trawl	Oct-Dec	0.00	41.59	13.61	17.25	21.11	3.14	2.79	0.41	0.06	0.03	80.9	3,188	123	1,526	
	Trawl	Jan-Apr	0.00	41.59	13.61	17.25	21.11	3.14	2.79	0.41	0.06	0.03	80.9	3,188	457	5,653	
	Seine	May	0.00	2.51	71.43	11.94	7.88	5.04	0.85	0.35	0.00	0.00	84.2	1,644	14,887	170,573	
19634	Seine	Jan-Apr	0.00	1.29	48.47	10.21	19.65	17.00	1.48	1.38	0.40	0.11	89.9	1,697	13,180	135,777	
	Seine	May	0.00	2.89	67.52	11.86	10.20	6.38	0.60	0.43	0.11	0.02	80.8	3,341	1,282	14,960	
	Trawl	Oct-Dec	0.00	3.26	65.07	10.15	11.10	8.96	0.69	0.60	0.12	0.03	85.8	3,341	44	0,519	
19645	Seine	Oct-Dec	0.00	3.26	65.07	10.15	11.10	8.96	0.69	0.60	0.12	0.03	85.8	3,341	537	6,254	
	Seine	Jan-Apr	0.00	9.22	19.05	45.55	10.13	10.34	4.75	0.71	0.22	0.03	127.7	825	5,435	40,840	
	Seine	May	0.00	4.99	13.41	53.55	9.70	9.66	7.23	1.03	0.37	0.06	118.0	2,088	12,851	99,593	
19656	Seine	Oct-Dec	0.00	6.54	15.87	50.81	10.48	9.83	5.18	0.59	0.34	0.77	124.0	2,893	25,924	191,386	
	Seine	Jan-Apr	0.00	0.00	5.29	21.38	23.45	16.32	19.08	9.66	3.22	1.61	137.3	0	3,312	24,120	
	Seine	May	0.00	0.00	5.29	21.38	23.45	16.32	19.08	9.66	3.22	1.61	137.3	0	9,151	66,643	
	Seine	Jan-Apr	0.00	0.00	5.29	21.38	23.45	16.32	19.08	9.66	3.22	1.61	137.3	0	4,831	35,181	
	Trawl	Jan-Apr	0.00	0.00	5.29	21.38	23.45	16.32	19.08	9.66	3.22	1.61	137.3	0	1	0,007	
	19667	Seine	Oct-Dec	0.00	57.22	32.31	5.37	1.88	2.70	0.41	0.20	0.00	0.00	65.7	0	4,379	66,650
	Seine	Jan-Apr	0.00	57.22	32.31	5.37	1.88	2.70	0.41	0.20	0.00	0.00	65.7	0	2,338	35,588	
	Seine	May	0.00	57.22	32.31	5.37	1.88	2.70	0.41	0.20	0.00	0.00	65.7	0	1,280	19,484	
	19678	Seine	Oct-Dec	0.00	34.87	39.74	19.40	4.59	0.73	0.26	0.14	0.27	0.00	77.9	0	53	0,678
	Seine	Jan-Apr	0.00	34.87	39.74	19.40	4.59	0.73	0.26	0.14	0.27	0.00	77.9	0	1,084	13,902	
	Seine	May	0.00	34.87	39.74	19.40	4.59	0.73	0.26	0.14	0.27	0.00	77.9	0	932	11,953	
	19690	Seine	Jan-Apr	0.00	18.57	62.81	15.11	3.12	0.03	0.08	0.08	0.00	0.00	81.6	0	1,330	16,304
19701	Seine	Jan-Apr	0.00	5.79	45.91	31.35	9.51	5.05	1.63	0.59	0.15	0.00	92.2	673	3,418	37,076	
	Seine	May	0.00	5.79	45.91	31.35	9.51	5.05	1.63	0.59	0.15	0.00	92.2	673	62	0,894	
	19712	Seine	Jan-Apr	0.00	0.00	5.32	17.93	64.43	5.88	3.78	2.38	0.14	0.14	161.3	714	4,490	27,842
	Gillnet	Jan-Apr	0.00	0.00	0.96	39.42	21.15	34.62	2.88	0.96	0.00	0.00	168.2	104	4	0,023	
	19723	Seine	Oct-Dec	0.00	3.89	35.37	4.95	27.58	23.05	3.26	1.26	0.63	0.00	133.3	950	16	0,123
	Seine	Jan-Apr	0.00	0.61	33.23	4.45	30.09	26.25	3.38	1.26	0.74	0.00	137.9	950	1,524	10,454	
	Seine	May	0.00	3.89	35.37	4.95	27.58	23.05	3.26	1.26	0.63	0.00	133.3	950	67	0,499	
	19734	Seine	Jan-Apr	0.00	0.16	17.88	53.16	7.44	16.46	4.43	0.32	0.16	0.00	132.2	632	2,300	17,401
	Gillnet	Jan-Apr	0.00	0.00	0.96	39.42	21.15	34.62	2.88	0.96	0.00	0.00	168.2	104	1,519	9,034	
19745	Seine	Jan-Apr	0.20	0.35	4.42	26.83	51.39	9.06	6.31	1.26	0.18	0.00	124.1	1,704	1,691	12,357	
	Gillnet	Jan-Apr	0.00	0.00	0.00	31.91	59.57	8.51	0.00	0.00	0.00	0.00	140.9	47	11	0,076	
	19756	Seine	Oct-Dec	0.00	0.00												



Table 1.2 Age composition and catch by season, fishery and gear type for the Prince Rupert District stock assessment region. Percentages represent a combination of samples taken from commercial fisheries and pre-fishery charters. Age-9++ represents the plus group of ages.

Season	Gear	Fishery	0+	1+	PERCENT AT AGE							Mean Weight	Number Aged	CATCH	
					2+	3+	4+	5+	6+	7+	8+			(tonnes)	(millions)
19778	Seine	Oct-Dec	0.00	1.66	7.66	32.30	17.60	16.98	13.46	6.21	2.48	1.66	483	2,263	14,977
	Seine	Jan-Apr	0.00	1.35	12.58	34.86	9.09	19.63	18.84	2.66	0.67	0.32	812	2,202	14,957
	Seine	May	0.00	1.73	12.50	38.39	9.35	18.12	15.88	2.73	0.92	0.38	147.1	1,295 +	68
	Trawl	Oct-Dec	0.00	1.36	10.03	31.95	13.18	19.41	17.48	4.37	1.43	0.79	150.3	1,396 +	1,024
	Trawl	Jan-Apr	0.00	0.99	2.97	20.79	19.80	25.74	20.79	7.92	0.99	0.00	167.6	101	0
19789	Gillnet	Jan-Apr	0.00	0.00	0.00	20.53	5.96	32.45	33.11	6.62	1.32	0.00	167.1	151 +	3,031
	Seine	Oct-Dec	0.00	1.42	9.81	10.85	25.36	19.39	17.10	8.63	4.73	2.71	152.3	777	971
	Seine	Jan-Apr	0.00	2.91	9.88	12.21	32.17	13.57	21.32	5.81	1.74	0.39	158.5	516	1,411
	Seine	May	0.00	2.19	14.84	11.37	26.12	14.72	17.26	6.93	2.94	1.62	151.3	1,732 +	10
	Trawl	Oct-Dec	0.00	2.04	9.07	10.37	27.96	15.37	15.37	8.52	7.04	4.26	147.9	540	690
19790	Trawl	Jan-Apr	0.00	2.04	9.07	10.37	27.96	15.37	15.37	8.52	7.04	4.26	147.9	540	0
	Gillnet	Jan-Apr	0.00	0.00	0.00	8.25	41.24	18.56	22.68	7.56	1.72	0.00	168.4	291 +	1,236
	Seine	Oct-Dec	0.00	1.82	82.62	6.88	6.93	7.57	5.81	5.21	2.12	1.04	108.2	1,049	460
	Seine	Jan-Apr	0.00	1.69	85.42	4.98	2.89	2.29	1.69	0.70	0.30	0.05	90.0	2,010	1,641
	Trawl	Oct-Dec	0.00	1.59	73.25	7.18	5.79	4.99	3.78	2.12	0.91	0.39	99.0	4,389 +	278
19801	Trawl	Jan-Apr	0.00	0.00	47.95	12.33	10.96	16.44	1.37	5.48	4.11	1.37	123.9	73	0
	Gillnet	Jan-Apr	0.00	0.00	0.00	7.66	35.25	19.92	19.54	8.43	3.45	0.77	162.2	261 +	1,546
	Seine	Oct-Dec	0.00	1.13	7.37	53.52	10.15	10.64	8.82	4.51	2.45	1.40	124.7	3,068	5,733
	Seine	Jan-Apr	0.53	0.57	10.08	82.32	3.36	1.46	1.55	0.32	0.19	0.13	98.7	3,156 +	1,051
	Trawl	Oct-Dec	0.50	1.07	7.67	56.82	8.62	9.09	9.02	3.68	2.37	1.66	119.0	3,095	949
19812	Trawl	Jan-Apr	0.00	1.07	7.21	55.35	8.89	9.56	9.66	4.17	2.36	1.74	121.0	3,095	0
	Gillnet	Jan-Apr	0.00	0.00	0.37	39.18	16.42	23.13	14.55	4.48	1.87	0.00	149.7	266 +	356
	Seine	Oct-Dec	0.00	0.83	14.25	24.70	45.73	6.01	3.80	3.07	1.13	0.49	128.5	1,143	794
	Seine	Jan-Apr	0.00	4.57	11.84	7.15	71.51	2.93	1.41	0.35	0.23	0.00	106.5	853	170
	Trawl	Oct-Dec	0.00	2.34	11.99	19.03	39.60	10.11	6.80	6.60	2.13	1.39	132.6	1,283	1,021
19823	Trawl	Jan-Apr	0.00	2.34	11.85	18.08	40.14	10.37	6.94	6.24	2.42	1.64	132.6	1,283	0
	Seine	Oct-Dec	0.00	1.35	20.82	17.74	5.28	49.16	3.73	1.13	0.59	0.22	117.7	4,583	0
	Seine	Jan-Apr	0.00	1.83	34.08	15.42	15.21	10.14	19.68	3.04	0.20	0.41	97.1	493	87
	Seine	May	0.00	0.43	32.79	11.18	9.48	17.31	27.38	0.95	0.33	0.14	106.6	3,118	1,679
	Trawl	Oct-Dec	0.00	0.72	36.17	14.18	10.77	13.79	22.65	1.27	0.28	0.17	102.7	3,611 +	6
19834	Trawl	Jan-Apr	0.00	0.93	36.45	14.29	10.74	13.57	21.95	1.30	0.42	0.34	102.3	3,772 +	54
	Gillnet	Jan-Apr	0.00	0.00	0.99	1.98	12.87	21.39	57.43	3.37	1.19	0.79	93.4	161	0
	Seine	Oct-Dec	0.00	17.10	8.92	20.45	30.67	12.83	4.46	4.28	0.93	0.37	86.0	538	48
	Seine	Jan-Apr	0.00	0.33	7.91	50.78	11.15	6.74	12.95	9.81	0.19	0.16	108.4	4,214	3,070
	Seine	May	0.00	2.15	7.95	50.48	14.31	7.07	10.01	7.61	0.27	0.17	108.3	4,752 +	70
19845	Trawl	Oct-Dec	0.00	2.31	7.95	50.46	14.58	7.09	9.74	7.41	0.27	0.17	105.8	4,752 +	83
	Gillnet	Jan-Apr	0.00	0.00	0.36	16.36	14.91	15.82	21.82	29.82	0.36	0.55	147.9	550	3,476
	Seine	Oct-Dec	0.00	1.77	12.72	10.13	44.29	9.00	5.23	8.78	7.96	0.11	139.2	3,554 +	130
	Seine	Jan-Apr	0.00	1.75	12.79	10.09	44.41	9.10	5.23	8.69	7.83	0.11	133.1	5,655	3,823
	Seine	May	0.00	1.69	13.34	9.55	48.09	10.53	5.26	7.46	5.98	0.10	137.1	5,655 +	105
19856	Trawl	Oct-Dec	0.00	12.11	11.13	9.48	27.58	16.27	9.30	5.81	5.02	3.30	137.9	1,635	47
	Trawl	Jan-Apr	0.00	12.11	11.13	9.48	27.58	16.27	9.30	5.81	5.02	3.30	137.9	1,635	0
	Gillnet	Jan-Apr	0.00	0.00	0.38	4.09	54.02	18.86	8.71	7.65	6.06	0.23	147.0	1,320	4,573
	Seine	Oct-Dec	0.00	0.60	38.78	9.59	7.26	29.94	5.64	3.59	3.09	1.33	117.1	2,977 +	47
	Seine	Jan-Apr	0.00	0.45	39.37	9.51	7.32	29.04	5.78	3.72	3.34	1.47	117.1	4,049	2,100
19867	Seine	May	0.00	1.06	36.99	9.81	7.06	32.66	6.01	3.21	2.31	0.89	117.1	2,977 +	52
	Gillnet	Jan-Apr	0.00	0.00	0.50	2.67	6.37	55.23	16.65	9.37	6.07	3.14	150.4	1,855	4,071
	Seine	Oct-Dec	0.00	0.52	35.53	36.87	5.23	7.15	11.18	1.59	1.43	0.49	100.3	3,076 +	23
	Seine	Jan-Apr	0.00	0.52	35.53	36.87	5.23	7.15	11.18	1.59	1.43	0.49	100.3	3,076 +	0
	Seine	May	0.00	0.45	30.98	39.94	5.97	8.35	11.53	1.95	1.45	0.38	102.6	4,206 +	56
19878	Trawl	Oct-Dec	0.00	0.26	13.73	41.19	11.92	11.14	11.92	4.40	4.15	1.30	109.5	386	0
	Gillnet	Jan-Apr	0.00	0.00	0.24	4.97	4.59	20.02	48.56	13.52	5.31	2.78	157.2	710	4,340
	Seine	Oct-Dec	0.00	0.21	25.24	29.11	30.29	4.94	4.83	4.40	0.64	0.32	105.0	931 +	42
	Seine	Jan-Apr	0.00	0.70	19.15	41.92	25.84	4.00	4.19	3.39	0.46	0.36	104.1	2,893	3,686
	Gillnet	Jan-Apr	0.00	0.00	0.00	5.11	30.02	13.98	22.91	21.87	3.66	2.46	149.3	476	4,745
19889	Seine	Oct-Dec	0.00	0.63	20.05	21.02	29.59	18.95	3.90	3.41	2.08	0.37	120.7	4,215	2,295
	Seine	Jan-Apr	0.00	0.14	14.00	25.59	26.19	24.51	3.85	3.58	1.99	0.14	120.9	5,066 +	32
	Gillnet	Jan-Apr	0.00	0.00	0.00	6.25	21.32	42.46	10.29	11.58	6.07	2.02	146.7	544	2,361
	Seine	Oct-Dec	0.00	1.07	51.92	9.89	11.11	15.82	7.54	1.23	0.91	1.03	98.8	2,529	1,348
	Trawl	Jan-Apr	0.00	0.55	40.80	10.75	16.94	17.49	11.29	1.82	0.00	0.36	108.1	549 +	19
19901	Gillnet	Jan-Apr	0.00	0.00	0.00	4.26	18.67	31.44	31.33	6.66	4.37	3.28	144.5	916	2,143
	Seine	Oct-Dec	0.00	0.19	45.84	29.44	6.36	5.42	7.73	3.60	0.74	0.67	96.6	4,265	1,377
	Seine	Jan-Apr	0.00	0.70	24.97	53.31	5.57	5.34	5.23	3.95	0.46	0.46	96.2	861 +	3
	Trawl	Oct-Dec	0.00	14.10	21.79	20.94	8.97	18.80	6.41	4.70	1.28	2.99	108.5	234	0
	Trawl	Jan-Apr	0.00	0.00	0.32	13.21	9.13	23.52	25.35	19.66	3.97	4.83	145.5	931	3,797
19912	Seine	Oct-Dec	0.00	0.04	6.28	56.22	21.93	4.18	4.46	4.86	1.59	0.44	103.4	3,262	2,204
	Seine	Jan-Apr	0.00	0.40	21.17	25.83	39.41	4.26	3.73	3.20	1.73	0.27	101.3	751 +	5
	Trawl	Oct-Dec	0.00	6.59	31.87	31.32	22.53	2.75	3.85	1.10	0.00	0.00	91.4	182	0
	Seine	Jan-Apr	0.00	0.00	0.00	8.32	40.54	9.53	18.52	13.29	8.19	1.61	134.1	745	4,112
	Gillnet	Jan-Apr	0.00	0.47	3.34	10.44	54.82	20.19	4.55	4.05	1.50	0.64	108.9	6,643	2,364
19923	Trawl	Oct-Dec	0.00	3.61	4.64	27.84	38.66	20.10	2.58	1.95	1.03	0.00	106.1	194	0
	Seine	Jan-Apr	0.08	3.62	12.91	4.38	9.57	49.66	13.84	2.46	1.44	0.82	113.1	3,532	899
	Gillnet	Jan-Apr	0.00	0.00	0.12	1.18	16.98	34.79	39.39	4.13	1.89	1.53	131.4	848	1,355
	Seine	Oct-Dec	0.00	1.08	65.37	8.54	2.82	4.26	11.72	5.19	0.37	0.26	89.0	2,697	0
	Gillnet	Jan-Apr	0.00	0.00	0.78	4.11	5.68	25.83	32.68	26.42	3.13	1.37	133.8	511	3,086
19956	Seine	Oct-Dec	0.00	1.30	22.79	53.63	8.01	2.52	4.93	4.74	1.85	0.22	88.5	2,698	0
	Gillnet	Jan-Apr	0.00	0.00	0.16	19.49	11.57	13.95	20.29	20.60	11.09	2.85	133.4	631	5,541

Table 1.2. Age composition and catch by season, fishery and gear type for the Prince Rupert District stock assessment region. Percentages represent a combination of samples taken from commercial fisheries and pre-fishery charters. Age-9+ represents the plus group of ages.

Season	Gear	Fishery	PERCENT AT AGE										Mean Weight	Number Aged	CATCH	
			0+	1+	2+	3+	4+	5+	6+	7+	8+	9+			(tonnes)	(millions)
19978	Seine	Jan-Apr	0.00	0.19	33.18	21.98	36.29	4.44	1.42	1.09	1.28	0.14	83.2	2 116	0	0.000
	Gillnet	Jan-Apr	0.00	0.00	0.65	3.05	43.07	20.52	9.89	11.28	7.02	4.53	127.9	1,082	3,945	30,856
19989	Seine	Jan-Apr	0.00	0.93	3.39	51.17	20.68	17.76	2.92	0.47	1.17	1.52	105.5	856	256	2,426
	Gillnet	Jan-Apr	0.00	0.00	0.00	11.17	16.23	48.99	13.24	4.72	2.20	3.46	126.1	721	1,895	15,011
19990	Seine	Jan-Apr	0.00	1.70	24.62	8.21	38.56	14.42	11.61	1.98	0.40	0.50	98.8	3,972	1,239	12,203
	Gillnet	Jan-Apr	0.00	0.00	0.12	2.10	23.06	20.47	42.17	9.37	1.11	1.80	133.7	811	3,076	23,002
20001	Seine	Jan-Apr	0.00	0.53	28.84	25.30	5.65	23.85	9.15	5.34	1.14	0.22	103.9	2,285	1,012	9,740
	Gillnet	Jan-Apr	0.00	0.00	0.29	5.58	9.33	32.40	20.57	25.58	5.29	0.87	134.3	1,040	1,906	14,186
20012	Seine	Oct-Dec	0.00	5.18	19.99	36.74	18.99	3.93	9.58	3.51	1.79	0.30	90.3	5,577 *	1	0.009
	Seine	Jan-Apr	0.00	7.21	19.39	32.03	20.34	4.16	11.12	3.83	1.60	0.33	93.0	3,678	2,061	22,159
	Gillnet	Jan-Apr	0.00	0.00	0.11	7.11	20.37	11.69	27.39	15.79	15.28	2.26	142.0	1,059	2,432	16,995
20023	Seine	Oct-Dec	0.00	0.79	67.83	13.49	11.10	3.13	1.52	1.15	0.48	0.51	85.1	659 *	5	0.068
	Seine	Jan-Apr	0.00	0.07	53.06	13.44	14.53	9.54	2.97	4.24	1.47	0.68	95.3	2,525	1,446	15,169
	Gillnet	Jan-Apr	0.00	0.00	0.34	4.60	37.13	25.98	10.57	12.30	5.29	3.79	136.6	870	2,562	18,758
20034	Seine	Oct-Dec	0.00	0.91	1.98	69.32	11.20	10.06	4.20	0.91	1.27	0.16	92.7	2,526 *	11	0.116
	Seine	Jan-Apr	0.00	0.88	1.76	69.88	10.58	9.88	4.45	0.97	1.39	0.19	96.0	2,155	1,908	19,886
	Gillnet	Jan-Apr	0.00	0.00	0.09	21.84	13.52	36.88	15.40	4.92	4.74	2.80	134.5	1,117	2,192	15.3
20045	Seine	Jan-Apr	0.00	0.75	26.86	8.94	45.29	9.23	6.00	2.02	0.51	0.42	91.1	2,872	1,750	18,938
	Gillnet	Jan-Apr	0.00	0.00	0.00	0.80	46.42	18.04	25.86	5.84	1.33	1.72	134.5	794	2,050	15,237
20056	Seine	Jan-Apr	0.00	1.45	16.34	44.33	8.80	22.99	3.90	1.60	0.45	0.15	87.1	2,001	957	10,981
	Gillnet	Jan-Apr	0.00	0.00	0.00	2.77	7.19	58.82	15.23	13.61	1.38	0.00	128.7	577	1,661	12,941
20067	Seine	Jan-Apr	0.00	3.69	48.50	21.99	10.66	3.01	9.84	1.23	0.96	0.14	11.6	732	0	0.000
	Gillnet	Jan-Apr	0.00	0.08	0.90	3.26	16.94	8.79	51.30	12.21	5.29	1.22	127.5	1,228	969	7,606
20078	Seine	Jan-Apr	0.00	1.50	9.82	56.89	13.82	10.45	2.18	4.24	0.75	0.36	93.3	2,526	513	5,498
	Gillnet	Jan-Apr	0.00	0.00	0.08	10.53	6.52	16.71	9.02	43.36	8.43	3.34	128.3	1,197	1,148	8,951
20089	Seine	Jan-Apr	0.00	0.08	23.78	14.00	45.78	7.70	5.72	1.28	1.59	0.08	100.8	2,586	713	7,077
	Gillnet	Jan-Apr	0.00	0.00	0.11	2.19	44.42	20.46	15.75	5.80	10.07	1.20	126.1	914	1,286	10,196

NOTE \* No biosample data available. Age composition and mean weight assigned from published reports.  
 + Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods. by gear type  
 - No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter



Table 1.3. Age composition and catch by season, fishery and gear type for the Central Coast stock assessment region. Percentages represent a combination of samples taken from commercial fisheries and pre-fishery charters. Age-9+ represents the plus group of ages.

Season	Gear	Fishery	P E R C E N T A T A G E										Mean Weight	Number Aged	C A T C H	
			0+	1+	2+	3+	4+	5+	6+	7+	8+	9+			(tonnes)	(millions)
19501	Sense	Oct-Dec	0.00	2.68	28.08	50.52	12.28	5.17	1.20	0.06	0.00	0.00	109.2	3.175	15.508	141.986
	Sense	Jan-Apr	0.06	2.25	31.20	49.36	11.23	4.84	1.06	0.01	0.00	0.00	107.9	2.143	26.950	250.936
19512	Sense	Jan-Apr	0.25	4.81	20.10	29.98	38.50	4.56	1.55	0.40	0.04	0.02	112.7	5.214	33.072	290.690
	Sense	May	1.11	5.12	19.85	29.75	37.71	4.45	1.52	0.44	0.04	0.02	112.3	5.214 +	123	1.091
19523	Sense	Jan-Apr	0.43	7.65	28.02	24.49	27.28	10.25	1.40	0.48	0.00	0.00	104.9	2.939	768	1.304
19534	Sense	Oct-Dec	0.15	7.31	69.86	17.41	3.99	1.06	0.15	0.00	0.08	0.00	83.6	1.327	6.389	100.473
	Sense	Jan-Apr	0.00	1.72	72.03	21.04	3.91	1.10	0.15	0.00	0.06	0.00	78.2	1.759	18.119	243.703
	Sense	May	0.67	4.04	89.18	20.52	4.63	1.34	0.16	0.00	0.07	0.00	71.1	3.066 +	109	1.931
19545	Sense	Oct-Dec	0.29	9.94	6.32	77.40	5.10	0.48	0.48	0.00	0.00	0.00	85.4	8.26	2.559	28.033
	Sense	Jan-Apr	0.00	1.31	5.42	80.39	11.08	1.56	0.25	0.00	0.00	0.00	99.8	1.524	9.035	80.856
19556	Sense	Oct-Dec	0.10	13.79	13.63	11.06	58.24	2.85	0.25	0.10	0.00	0.00	91.4	2.408	22.335	208.767
	Sense	Jan-Apr	0.00	7.39	12.21	8.70	67.86	3.36	0.43	0.00	0.00	0.04	114.2	2.614	21.018	178.311
	Sense	May	0.04	16.97	13.60	9.12	56.99	2.89	0.34	0.04	0.00	0.02	105.4	5.022 +	275	2.606
19567	Sense	Oct-Dec	0.00	52.32	42.90	3.83	0.55	0.27	0.14	0.00	0.00	0.00	60.1	7.32	1.788	29.756
	Sense	Jan-Apr	0.00	3.59	52.30	13.96	8.33	20.79	0.98	0.03	0.00	0.00	93.9	3.890	21.002	211.756
	Sense	May	0.00	23.13	49.84	9.53	5.03	11.85	0.59	0.02	0.00	0.00	79.6	4.622 +	470	5.669
19578	Sense	Oct-Dec	0.00	40.38	49.69	8.01	1.33	0.17	0.42	0.01	0.00	0.00	81.5	2.196	4.928	79.258
	Sense	Jan-Apr	0.00	5.87	73.81	17.33	1.50	1.22	0.65	0.00	0.00	0.00	79.8	1.472	4.454	60.180
	Sense	May	0.00	47.57	42.11	7.27	3.01	0.42	0.62	0.00	0.00	0.00	84.8	3.578 +	467	8.141
19589	Sense	Oct-Dec	0.17	5.25	49.47	35.94	7.43	0.61	0.57	0.55	0.01	0.00	83.4	2.169	10.774	125.789
	Sense	Jan-Apr	0.00	0.74	47.39	49.66	9.62	0.72	0.52	0.35	0.00	0.00	88.2	2.594	17.096	192.788
19590	Sense	Oct-Dec	0.00	42.87	24.11	26.16	5.59	1.10	0.08	0.08	0.00	0.00	62.1	1.269	3.397	54.675
	Sense	Jan-Apr	0.00	41.51	23.53	27.72	5.86	1.22	0.08	0.08	0.00	0.00	63.7	1.313 +	640	10.054
19601	Sense	Oct-Dec	0.00	64.30	28.81	3.34	2.30	1.25	0.00	0.00	0.00	0.00	51.4	4.79	956	18.561
	Sense	Jan-Apr	0.00	4.30	32.84	12.80	36.63	12.48	0.94	0.16	0.05	0.00	100.6	2.302	30.641	302.709
	Sense	May	0.00	16.18	32.43	10.82	29.70	9.92	0.79	0.11	0.04	0.00	91.1	2.781 +	104	1.136
	Trawl	May	0.00	16.18	32.43	10.82	29.70	9.92	0.79	0.11	0.04	0.00	91.1	2.781 +	4	0.042
19612	Sense	Oct-Dec	0.00	7.65	54.80	20.82	2.85	11.39	2.31	0.18	0.00	0.00	84.1	5.62 +	677	7.197
	Sense	Jan-Apr	0.00	3.73	51.28	25.17	2.80	13.99	2.80	0.23	0.00	0.00	99.6	4.29	14.942	150.045
	Sense	May	0.00	7.65	54.80	20.82	2.85	11.39	2.31	0.18	0.00	0.00	84.1	5.62 +	90	0.954
19623	Sense	Oct-Dec	0.00	0.36	30.27	58.03	5.25	2.98	0.02	0.21	0.00	0.00	100.6	1.052 +	124	1.232
	Sense	Jan-Apr	0.00	0.35	30.14	58.19	5.18	2.86	0.07	0.21	0.00	0.00	100.6	1.052	43.530	436.570
19634	Sense	Oct-Dec	0.00	14.03	46.96	27.37	10.09	1.45	0.09	0.00	0.00	0.00	91.1	1.169 +	3.214	35.288
	Sense	Jan-Apr	0.00	4.88	43.06	35.48	14.65	1.80	0.13	0.00	0.00	0.00	103.4	7.78	28.288	273.620
	Sense	May	0.00	14.03	46.96	27.37	10.09	1.45	0.09	0.00	0.00	0.00	91.1	1.169 +	165	1.808
	Trawl	Jan-Apr	0.00	14.03	46.96	27.37	10.09	1.45	0.09	0.00	0.00	0.00	91.1	1.169 +	228	2.507
19645	Sense	Oct-Dec	0.00	14.07	37.58	31.01	12.10	5.03	0.18	0.03	0.00	0.00	114.4	1.750 +	1.562	14.266
	Sense	Jan-Apr	0.00	3.62	35.16	37.44	17.59	5.77	0.39	0.03	0.00	0.00	122.3	1.852	12.630	101.310
	Sense	May	0.00	8.49	36.46	33.62	15.63	5.41	0.33	0.06	0.00	0.00	111.9	1.750 +	1.477	12.553
19656	Sense	Oct-Dec	0.00	67.32	20.43	7.33	3.60	1.13	0.19	0.00	0.00	0.00	71.9	0	16.217	225.703
	Sense	Jan-Apr	0.00	67.32	20.43	7.33	3.60	1.13	0.19	0.00	0.00	0.00	71.9	0	18.01	265.835
	Sense	May	0.00	67.32	20.43	7.33	3.60	1.13	0.19	0.00	0.00	0.00	71.9	0	2.163	30.107
19667	Sense	Oct-Dec	0.00	37.40	46.19	13.10	2.04	1.02	0.17	0.07	0.01	0.00	87.0	0	2.910	33.432
	Sense	Jan-Apr	0.00	37.40	46.19	13.10	2.04	1.02	0.17	0.07	0.01	0.00	87.0	0	17.206	197.668
	Sense	May	0.00	37.40	46.19	13.10	2.04	1.02	0.17	0.07	0.01	0.00	87.0	0	1.774	20.378
19678	Sense	Oct-Dec	0.00	32.53	48.02	17.02	2.11	0.25	0.00	0.06	0.00	0.00	89.8	0	497	5.535
	Sense	Jan-Apr	0.00	32.53	48.02	17.02	2.11	0.25	0.00	0.06	0.00	0.00	89.8	0	309	3.439
	Sense	May	0.00	32.53	48.02	17.02	2.11	0.25	0.00	0.06	0.00	0.00	89.8	0	722	8.043
19690	Sense	Jan-Apr	0.00	54.02	44.42	1.16	0.40	0.00	0.00	0.00	0.00	0.00	73.9	0	209	2.832
19701	Sense	Jan-Apr	0.06	12.04	39.34	39.20	4.11	4.33	0.72	0.06	0.13	0.00	108.2	953	3.614	32.684
19712	Sense	Jan-Apr	0.00	3.54	28.25	27.13	27.01	7.57	5.17	1.26	0.08	0.00	120.5	1.763	9.143	74.425
	Gillnet	Jan-Apr	0.00	0.00	2.21	18.18	81.36	11.36	6.82	0.00	0.00	0.00	159.6	44 +	137	0.855
19723	Sense	Jan-Apr	0.00	0.97	48.51	18.90	16.23	12.72	2.02	0.47	0.19	0.00	125.2	1.239	6.664	52.842
	Sense	May	0.00	1.21	49.64	18.40	15.98	12.11	2.02	0.48	0.16	0.00	124.7	1.239 +	22	0.178
	Gillnet	Jan-Apr	0.00	0.00	4.04	28.28	43.43	21.21	2.02	1.01	0.00	0.00	152.5	99 +	1.113	7.288
19734	Sense	Jan-Apr	0.00	2.94	20.26	42.18	18.05	10.26	5.42	0.71	0.18	0.00	129.5	1.515	3.621	28.838
	Gillnet	Jan-Apr	0.00	0.00	0.42	22.36	38.82	24.47	12.24	1.69	0.00	0.00	158.5	474	5.267	33.230
19745	Sense	Jan-Apr	0.18	0.99	48.84	22.87	19.00	5.33	2.25	0.48	0.04	0.02	119.5	8.923	3.343	31.457
	Gillnet	Jan-Apr	0.00	0.00	4.21	26.40	45.80	15.73	5.60	2.40	0.00	0.00	152.8	375 +	5.395	35.219
19756	Sense	Jan-Apr	0.00	2.18	11.33	41.86	21.86	16.69	4.31	1.52	0.24	0.02	124.4	5.418	6.188	50.662
	Gillnet	Jan-Apr	0.00	0.00	0.86	18.72	30.18	35.12	11.56	3.02	0.44	0.09	162.0	1.222	6.213	38.357
19767	Sense	Jan-Apr	0.00	0.70	17.01	23.32	31.11	17.06	8.70	1.72	0.34	0.05	136.6	2.606	4.201	30.702
	Gillnet	Jan-Apr	0.00	0.00	1.10	13.02	35.54	31.57	13.47	3.97	1.32	0.00	167.7	453	6.904	41.171
19778	Sense	Jan-Apr	0.00	0.19	28.64	16.47	21.54	21.13	8.68	2.56	0.59	0.21	129.6	1.391	4.723	37.629
	Sense	May	0.00	0.18	27.21	16.70	21.83	20.76	8.28	2.38	0.50	0.17	124.6	1.391 +	46	0.369
	Gillnet	Jan-Apr	0.00	0.00	0.83	8.45	32.10	38.26	16.57	3.21	0.44	0.15	162.1	896	9.277	56.466
19789	Sense	Oct-Dec	0.00	5.70	4.40	31.50	18.70	21.30	15.10	2.80	0.40	0.10	151.8	0	0	0.001
	Sense	May	0.00	5.70	4.40	31.50	18.70	21.30	15.10	2.80	0.40	0.10	151.8	0	5	0.031
19790	Sense	Oct-Dec	0.06	5.59	89.33	6.94	9.48	4.51	2.87	0.72	0.42	0.09	91.4	3.345 +	10	0.111
	Sense	Jan-Apr	0.06	5.59	89.33	6.94	9.48	4.51	2.87	0.72	0.42	0.09	91.4	3.345	0	0.000
	Gillnet	Jan-Apr	0.00	0.00	5.36	0.89	34.82	21.43	18.75	11.61	6.25	0.89	157.9	112 +	528	3.347
19801	Sense	Jan-Apr	0.00	1.88	14.92	68.45	7.06	4.89	1.95	0.44	0.29	0.04	101.3	5.210	263	2.570
	Sense	May	0.00	3.78	14.57	63.82	7.83	6.03	2.80	0.67	0.36	0.13	99.2	5.210 +	6	0.063
	Gillnet	Jan-Apr	0.00	0.28	1.47	47.46	12.43	15.35	12.78	6.94	2.48	0.82	142.5	1.418	2.304	15.892
19812	Sense	Jan-Apr	0.00	0.61	11.52	10.17	66.35	5.52	4.26	1.26	0.30	0.00	131.9	2.300	2.258	17.116
	Sense	May	0.00	0.61	11.52	10.17	66.35	5.52	4.26	1.26	0.30	0.00	131.9	2		

Table 1.3. Age composition and catch by season, fishery and gear type for the Central Coast stock assessment region. Percentages represent a combination of samples taken from commercial fisheries and pre-fishery charters. Age-9++ represents the plus group of ages.

Season	Gear	Fishery	PERCENT AT AGE										Mean Weight	Number Aged	CATCH	
			0+	1+	2+	3+	4+	5+	6+	7+	8+	9++			(tonnes)	(millions)
1983A	Seine	Jan-Apr	0.00	2.29	5.47	7.67	17.73	17.04	47.03	1.93	0.69	0.14	128.0	6,294	3,589	28,383
	Gillnet	Jan-Apr	0.00	0.00	0.27	2.69	12.49	16.84	61.49	4.63	1.07	0.53	145.1	1,092	3,582	24,536
1984S	Seine	Jan-Apr	0.00	0.61	28.72	8.11	9.89	17.28	14.48	20.15	0.49	0.26	136.5	3,690	2,915	20,337
	Gillnet	Jan-Apr	0.00	0.00	7.78	6.27	9.37	20.53	23.37	35.09	0.85	0.44	161.3	1,507	2,294	14,583
1985S	Seine	Oct-Dec	0.00	4.00	16.21	39.67	8.61	8.81	6.74	6.12	11.63	0.62	138.5	5,995 *	30	0.224
	Trawl	Jan-Apr	0.00	4.50	16.21	39.67	8.61	8.81	6.74	6.12	11.63	0.62	138.7	3,983	2,173	16,047
	Gillnet	Jan-Apr	0.00	0.00	2.01	21.83	14.43	7.98	14.53	14.47	24.18	0.56	155.5	1,020	1,118	7,676
1986S	Seine	Jan-Apr	0.00	4.13	20.03	13.26	32.77	5.80	5.06	6.71	5.11	7.33	143.9	3,614	2,695	18,225
	Gillnet	Jan-Apr	0.00	0.00	0.82	7.75	44.85	11.72	7.85	9.69	6.15	8.97	165.2	981	920	5,371
1987S	Seine	Jan-Apr	0.00	0.82	65.64	12.35	6.16	8.30	1.73	1.71	1.68	1.40	107.5	4,159	3,539	31,909
	Seine	May	0.00	0.81	65.96	12.42	6.14	8.29	1.68	1.73	1.68	1.34	110.9	2,835 *	18	0.162
	Gillnet	Jan-Apr	0.00	0.00	4.39	10.69	15.27	27.48	13.74	7.06	9.73	11.64	162.2	524	910	5,978
1988S	Seine	Jan-Apr	0.00	0.84	3.72	79.59	8.59	2.79	2.28	0.60	0.87	0.71	112.1	4,321	6,531	61,253
	Gillnet	Jan-Apr	0.00	0.00	0.32	29.13	25.73	17.31	14.72	5.34	3.72	3.72	147.9	616	2,911	19,680
1989S	Seine	Jan-Apr	0.00	0.81	3.55	5.07	74.01	7.47	3.93	3.48	0.81	0.85	131.1	6,843	5,305	39,561
	Gillnet	Jan-Apr	0.00	0.00	0.00	1.03	68.15	16.46	5.46	6.48	1.10	1.32	144.7	906	3,046	20,918
1990S	Seine	Jan-Apr	0.00	1.76	16.48	14.41	6.52	56.72	6.70	2.34	1.70	0.36	133.9	7,107	7,097	32,412
	Gillnet	Jan-Apr	0.00	0.00	0.56	2.41	6.35	69.81	9.64	7.04	3.52	0.93	154.7	540	1,606	11,673
1991S	Seine	Jan-Apr	0.00	0.94	60.91	10.17	2.47	2.95	19.02	2.03	0.79	0.72	107.2	7,264	7,251	56,620
	Gillnet	Jan-Apr	0.00	0.00	6.87	6.96	4.42	6.98	60.93	9.67	2.99	1.19	155.6	1,119	1,111	6,891
1992S	Seine	Jan-Apr	0.00	3.37	7.06	63.75	9.66	1.85	2.41	10.22	1.24	0.43	112.3	6,939	8,478	75,838
	Gillnet	Jan-Apr	0.00	0.00	0.20	45.74	14.12	5.43	5.88	25.47	2.48	0.67	138.9	781	2,038	14,682
1993A	Seine	Jan-Apr	0.00	0.87	18.91	7.17	56.09	7.93	2.09	3.02	3.51	0.42	118.7	8,174	9,757	81,704
	Gillnet	Jan-Apr	0.00	0.00	1.73	5.09	66.34	12.30	3.27	4.00	6.51	0.77	133.8	1,951	2,122	15,809
1994S	Seine	Jan-Apr	0.00	0.58	5.12	22.95	9.25	49.46	6.30	2.18	2.34	1.81	127.0	8,932	8,131	64,167
	Gillnet	Jan-Apr	0.00	0.00	0.23	8.93	8.00	64.94	10.67	1.79	2.23	3.31	137.4	1,267	1,451	10,565
1995S	Seine	Jan-Apr	0.00	12.82	18.28	5.03	16.68	7.26	31.17	5.99	1.57	1.31	124.2	4,087	3,897	32,478
	Gillnet	Jan-Apr	0.00	0.00	0.39	1.55	18.33	11.88	53.07	10.48	1.97	2.33	146.4	586	432	2,743
1996S	Seine	Jan-Apr	0.00	2.20	56.77	15.70	3.46	6.65	4.27	8.66	1.70	0.56	94.3	5,235	3,276	34,713
	Gillnet	Jan-Apr	0.00	0.00	1.36	2.92	6.23	22.76	19.26	38.33	7.20	1.95	143.5	514	344	2,401
1997S	Seine	Jan-Apr	0.00	10.57	31.97	41.69	8.77	2.75	5.02	4.40	4.08	0.96	90.0	4,825	12,670	134,718
	Gillnet	Jan-Apr	0.00	0.00	0.50	14.82	14.10	8.79	17.80	15.74	20.76	7.69	140.4	1,051	800	5,675
1998S	Seine	Jan-Apr	0.00	0.38	8.40	39.78	34.47	7.86	2.20	2.87	2.70	1.55	100.0	3,861	6,311	61,746
	Gillnet	Jan-Apr	0.00	0.00	0.13	15.27	43.02	17.80	6.24	5.31	5.44	4.78	128.8	753	1,324	11,833
1999S	Seine	Jan-Apr	0.00	0.20	17.33	10.45	32.95	28.80	6.40	1.45	1.77	1.26	112.6	4,527	6,394	55,294
	Gillnet	Jan-Apr	0.00	0.00	0.44	2.04	40.44	41.67	10.36	1.61	0.88	0.63	133.0	685	972	7,354
2000S	Seine	Jan-Apr	0.01	2.12	7.10	24.85	12.48	25.25	21.35	5.12	1.17	0.57	117.5	3,070	5,613	47,004
	Gillnet	Jan-Apr	0.00	0.00	0.00	4.87	5.75	52.75	28.13	7.12	1.13	0.25	135.3	800	517	3,823
2001S	Seine	Jan-Apr	0.00	4.14	33.85	10.20	18.51	5.90	19.75	8.00	1.35	0.29	96.5	5,894	2,894	29,510
	Gillnet	Jan-Apr	0.00	0.00	0.60	5.95	20.83	7.54	47.02	16.47	1.39	0.20	128.6	504	399	3,099
2002S	Seine	Jan-Apr	0.00	0.09	30.97	24.46	9.95	12.92	5.79	11.12	3.98	0.72	104.9	2,212	2,299	21,910
	Gillnet	Jan-Apr	0.00	0.00	0.43	3.57	11.14	25.73	11.24	33.08	12.32	2.49	143.2	925	289	2,020
2003A	Seine	Jan-Apr	0.00	1.27	6.44	65.95	16.06	2.98	3.46	1.74	1.67	0.43	96.1	2,094	2,988	30,960
2004S	Seine	Jan-Apr	0.00	0.50	33.46	16.82	34.91	9.13	1.96	1.74	1.09	0.56	88.5	5,728	3,778	41,595
2005S	Seine	Jan-Apr	0.00	0.84	10.82	56.17	10.59	16.51	3.51	0.77	0.60	0.19	86.7	8,835	3,672	38,945
2006S	Seine	Jan-Apr	0.29	1.32	29.35	20.47	29.70	9.33	7.73	1.35	0.38	0.08	86.3	2,343	398	4,588
2007S	Seine	Jan-Apr	0.00	10.12	10.20	44.83	12.51	15.91	2.82	2.89	0.58	0.14	79.3	1,383	0	0.000
2008S	Seine	Jan-Apr	0.00	2.13	73.14	10.94	8.45	2.38	3.24	0.28	0.36	0.07	71.3	2,815	0	0.000

NOTE: \* No biosample data available. Age composition and mean weight assigned from published reports.  
 + Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods, by gear type.  
 - No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter.

Table 1.4. Age composition and catch by season, fishery and gear type for the Strait of Georgia stock assessment region. Percentages represent a combination of samples taken from commercial fisheries and pre-fishery charters. Age-9+ represents the plus group of ages.

Season	Gear	Fishery	PERCENT AT AGE										Mean Weight	Number Aged	CATCH	
			0+	1+	2+	3+	4+	5+	6+	7+	8+	9+			(tonnes)	(millions)
19501	Seine	Oct-Dec	0.03	4.32	58.16	28.95	6.71	1.40	0.30	0.10	0.02	0.00	99.6	7.816	42.180	424.795
	Seine	Jan-Apr	0.06	4.40	32.64	48.59	10.65	2.79	0.62	0.23	0.06	0.00	103.6	1.774	1.226	11.828
	Seine	May	0.04	3.48	61.00	28.57	7.12	1.25	0.43	0.12	0.00	0.00	99.5	7.818	1.226	9.923
	Seine	Oct-Dec	0.11	14.85	35.11	21.73	6.50	1.32	0.28	0.08	0.01	0.00	93.0	8.839	44.996	492.871
	Seine	Jan-Apr	0.16	21.00	49.73	21.23	6.21	1.51	0.11	0.05	0.00	0.00	92.4	8.839	438	5.011
19512	Seine	May	0.03	3.99	58.50	29.71	7.17	1.34	0.20	0.05	0.00	0.00	96.6	8.839	551	5.472
	Trawl	Jan-Apr	0.00	0.00	50.26	38.79	9.84	2.59	0.52	0.05	0.00	0.00	113.6	180	0	0.000
	Seine	Oct-Dec	0.11	1.74	54.75	38.79	5.97	0.52	0.07	0.10	0.00	0.00	85.9	3.610	3.757	41.534
	Seine	Jan-Apr	0.14	3.79	65.35	27.05	2.97	0.62	0.07	0.00	0.00	0.00	81.0	5.220	3.986	48.795
	Seine	May	0.17	6.67	55.64	37.01	3.71	0.63	0.09	0.01	0.00	0.00	94.1	9.030	447	5.124
19523	Trawl	Oct-Dec	0.00	1.58	63.29	30.79	3.68	0.66	0.00	0.00	0.00	0.00	88.4	760	26	0.326
	Trawl	Jan-Apr	0.00	8.91	67.27	23.62	2.60	0.60	0.00	0.00	0.00	0.00	78.0	999	225	2.888
	Seine	Oct-Dec	0.00	1.12	53.87	36.36	6.93	1.38	0.27	0.06	0.01	0.00	96.0	9.693	57.443	595.913
	Seine	Jan-Apr	0.00	2.17	43.19	41.52	6.91	3.32	0.70	0.18	0.01	0.00	94.0	3.618	919	6.600
	Seine	May	0.00	1.76	22.05	37.29	26.45	8.78	3.69	0.60	0.07	0.00	119.9	3.574	7.692	62.447
19534	Trawl	Jan-Apr	0.00	1.36	52.67	36.83	7.07	1.86	0.33	0.08	0.01	0.00	99.7	9.788	14	0.142
	Seine	Oct-Dec	0.00	3.92	56.38	33.92	5.18	1.32	0.98	0.00	0.00	0.00	98.0	8.028	50.504	520.381
	Seine	Jan-Apr	0.00	3.90	22.36	60.88	11.00	2.21	0.15	0.00	0.00	0.00	93.6	8.96	13.825	161.966
	Seine	May	0.00	4.65	49.67	36.62	5.95	0.82	0.10	0.00	0.00	0.00	94.5	4.924	4.207	43.919
	Trawl	Oct-Dec	0.00	4.65	50.12	38.35	5.99	0.80	0.10	0.00	0.00	0.00	95.9	4.994	0	0.004
19545	Trawl	Jan-Apr	0.00	8.57	57.14	25.71	8.57	0.00	0.00	0.00	0.00	0.00	84.7	70	0	0.000
	Seine	Oct-Dec	0.00	4.07	32.03	39.65	11.30	1.65	0.29	0.00	0.00	0.00	97.4	3.783	44.043	451.810
	Seine	Jan-Apr	0.00	8.10	14.20	29.99	41.94	1.87	1.37	0.43	0.09	0.02	109.1	4.810	26.375	243.982
	Seine	May	0.00	0.13	9.76	43.52	26.32	17.07	2.44	0.64	0.00	0.13	129.0	776	1.462	11.648
	Trawl	Oct-Dec	0.00	3.52	58.00	26.95	8.19	1.06	0.29	0.00	0.00	0.00	93.7	1.050	180	1.944
19556	Trawl	Jan-Apr	0.00	18.62	44.38	24.62	10.24	1.91	0.73	0.00	0.00	0.00	85.7	3.197	0	0.000
	Seine	Oct-Dec	0.00	0.73	64.76	20.31	9.37	4.25	0.51	0.04	0.00	0.00	96.2	4.991	44.241	460.767
	Seine	Jan-Apr	0.00	1.42	54.96	21.83	7.50	3.97	0.31	0.00	0.00	0.00	95.7	826	8.202	84.577
	Seine	May	0.00	3.46	18.92	49.97	25.30	9.95	1.08	0.11	0.11	0.11	129.9	923	7.185	55.146
	Trawl	Jan-Apr	0.12	2.24	71.83	14.15	4.60	0.66	0.64	0.06	0.00	0.12	91.7	948	0	0.000
19567	Seine	Oct-Dec	0.00	16.67	50.24	20.46	3.65	3.20	1.64	0.15	0.04	0.00	98.9	3.085	17.141	133.617
	Seine	Jan-Apr	0.00	9.97	61.67	18.52	4.36	3.96	3.34	0.49	0.00	0.00	99.1	1.830	6.982	84.814
	Seine	May	0.00	9.00	60.10	21.06	3.99	3.20	3.00	0.30	0.05	0.00	99.9	4.935	1.206	13.587
	Trawl	Jan-Apr	0.00	12.72	73.29	11.84	1.88	0.45	0.01	0.01	0.00	0.00	14.6	527	995	9.491
	Gillnet	Jan-Apr	0.00	24.49	53.06	18.37	0.00	2.04	0.00	2.04	0.00	0.00	76.1	49	0	0.000
19589	Seine	Oct-Dec	0.74	13.95	56.31	15.95	2.34	0.39	0.21	0.10	0.01	0.00	83.5	7.169	47.601	575.751
	Seine	Jan-Apr	0.86	14.21	65.57	16.41	2.29	0.39	0.21	0.06	0.01	0.00	82.4	7.215	146	1.770
	Seine	May	0.00	25.55	57.59	10.96	3.72	1.52	0.27	0.29	0.09	0.00	79.4	5.006	1.897	23.638
	Trawl	Jan-Apr	1.52	19.81	59.43	18.10	1.14	0.80	0.00	0.00	0.00	0.00	72.9	525	0	0.000
	Gillnet	Oct-Dec	0.00	24.49	53.06	18.37	0.00	2.04	0.00	2.04	0.00	0.00	76.1	49	0	0.000
19590	Seine	Oct-Dec	0.00	6.80	54.12	35.60	2.93	0.36	0.00	0.07	0.00	0.02	96.1	3.223	67.866	685.617
	Seine	Jan-Apr	0.00	23.34	56.24	24.15	2.11	0.00	0.16	0.00	0.00	0.00	79.8	617	149	1.862
	Trawl	Oct-Dec	0.00	10.10	51.47	34.80	3.07	0.39	0.10	0.08	0.00	0.00	93.7	3.940	23	0.237
	Seine	Oct-Dec	0.00	40.17	50.81	22.99	5.94	0.00	0.00	0.00	0.00	0.00	98.0	2.046	35.847	303.907
	Seine	Jan-Apr	0.00	31.84	24.60	25.78	15.95	1.83	0.11	0.00	0.00	0.00	95.0	1.186	9.335	115.676
19601	Seine	May	0.00	0.16	28.79	22.54	26.28	16.66	2.35	0.31	0.00	0.00	114.2	939	9.119	79.855
	Trawl	Oct-Dec	0.00	36.75	38.27	19.59	8.24	0.15	0.00	0.00	0.00	0.00	85.8	689	1.329	15.472
	Seine	Oct-Dec	0.00	38.75	35.27	19.59	8.24	0.15	0.00	0.00	0.00	0.00	85.8	689	586	6.822
	Seine	Oct-Dec	0.00	9.92	71.21	12.79	4.02	1.72	0.33	0.00	0.00	0.00	88.6	2.824	53.725	602.612
	Seine	Jan-Apr	0.00	13.01	67.96	15.71	5.23	2.56	0.60	0.00	0.00	0.00	87.8	2.824	36	0.412
19612	Seine	May	0.00	9.42	71.71	13.00	3.96	1.87	0.62	0.02	0.00	0.00	88.8	2.824	10.747	120.280
	Trawl	Oct-Dec	0.00	9.98	71.49	12.80	4.11	1.59	0.35	0.04	0.00	0.00	89.0	2.824	780	8.818
	Trawl	Jan-Apr	0.00	9.98	71.49	12.80	4.11	1.59	0.35	0.04	0.00	0.00	89.0	2.824	9	0.106
	Seine	Oct-Dec	0.00	13.94	50.76	29.50	3.49	0.19	0.04	0.04	0.00	0.00	96.6	1.596	36.950	651.147
	Seine	Jan-Apr	0.00	31.58	47.43	19.36	2.89	1.77	0.11	0.35	0.00	0.00	81.8	1.668	5.314	71.025
19623	Seine	May	0.00	16.90	51.64	28.95	3.90	1.26	0.48	0.10	0.00	0.00	82.8	1.968	6.885	79.351
	Trawl	Oct-Dec	0.00	17.03	52.56	26.29	3.13	0.66	0.24	0.09	0.00	0.00	83.4	2.108	200	2.392
	Trawl	Jan-Apr	0.00	17.03	52.56	26.29	3.13	0.66	0.24	0.09	0.00	0.00	83.4	2.108	47	0.567
	Seine	Oct-Dec	0.00	4.50	63.37	29.55	2.20	0.47	0.05	0.07	0.00	0.00	103.4	3.255	69.538	826.573
	Seine	Jan-Apr	0.00	36.97	50.73	14.68	3.04	0.88	0.18	0.23	0.00	0.00	94.8	0	1.034	10.909
19634	Seine	May	0.00	30.47	50.81	14.68	3.04	0.88	0.18	0.23	0.00	0.00	94.8	0	58	0.616
	Trawl	Jan-Apr	0.00	36.97	50.82	14.68	3.04	0.88	0.18	0.23	0.00	0.00	94.8	0	730	7.390
	Trawl	Oct-Dec	0.00	30.37	50.82	14.68	3.04	0.88	0.18	0.23	0.00	0.00	94.8	0	101	1.061
	Seine	Jan-Apr	0.00	31.84	60.32	9.49	3.27	0.72	0.86	0.00	0.00	0.00	95.5	0	1	0.007
	Seine	May	0.00	35.64	60.32	9.49	3.27	0.72	0.86	0.00	0.00	0.00	95.5	0	220	2.289
19634	Trawl	Jan-Apr	0.00	25.64	60.32	9.49	3.27	0.72	0.86	0.00	0.00	0.00	95.5	0	0	0.004
	Gillnet	Jan-Apr	0.00	25.64	60.32	9.49	3.27	0.72	0.86	0.00	0.00	0.00	95.5	0	23	0.243
	Seine	Oct-Dec	0.00	12.33	40.03	36.36	7.12	2.82	0.92	0.07	0.00	0.00	114.8	1.419	589	5.118
	Seine	Jan-Apr	0.43	13.36	41.17	34.74	7.01	2.58	0.87	0.04	0.00	0.00	113.0	1.419	957	7.672
	Seine	May	0.00	12.33	40.03	36.36	7.12	2.82	0.92	0.07	0.00	0.00	114.8	1.419	96	5.177
19701	Trawl	Oct-Dec	0.00	12.33	40.03	36.36	7.12	2.82	0.92	0.07	0.00	0.00	114.8	1.419	95	5.828
	Trawl	Jan-Apr	0.00	12.33	40.03	36.36	7.12	2.82	0.92	0.07	0.00	0.00	114.8	1.419	4	0.032
	Gillnet	Oct-Dec	0.00	4.58	11.75	46.61	28.49	8.77	1.49	0.20	0.10	0.00	140.1	1.004	42	0.303
	Gillnet	Jan-Apr	0.00	4.58	11.75	46.61	28.49	8.77	1.49	0.20	0.10	0.00	140.1	1.004	44	0.315
	Gillnet	May	0.00	4.58	11.75	46.61	28.49	8.77	1.49	0.20	0.10	0.00	140.1	1.004	73	0.323
19712	Trawl	Oct-Dec	0.06	12.78	32.57	53.30	16.53	3.96	1.17	0.12	0.00	0.00	126.0	0	1.011	8.271
	Seine	Jan-Apr	0.00	6.99	32.76	36.27	19.69	4.21	1.20	0.00	0.00	0.00	110.1	1.262	7.240	83.276
	Seine	May	0.01	4.41	29.76	34.98	22.5									

Table 1.4 Age composition and catch by season, fishery and gear type for the Strait of Georgia stock assessment region. Percentages represent a combination of samples taken from commercial fisheries and pre-fishery charters. Age-9+ represents the plus group of ages.

Season	Gear	Fishery	PERCENT AT AGE										Mean Weight	Number Aged	CATCH	
			0+	1+	2+	3+	4+	5+	6+	7+	8+	9+			(tonnes)	(millions)
19723	Seine	Oct-Dec	0.00	3.37	50.48	20.94	18.35	5.39	0.91	0.45	0.11	0.00	120.6	1,071	256	2,082
	Seine	Jan-Apr	0.08	1.88	36.48	29.31	20.75	10.01	1.24	0.14	0.01	0.00	130.3	4,643	5,181	41,003
	Seine	May	0.09	3.35	39.83	27.62	19.88	7.90	1.15	0.33	0.05	0.00	124.1	5,714	187	1,351
	Trawl	Oct-Dec	0.10	1.89	31.61	30.52	23.07	11.01	1.51	0.26	0.03	0.00	130.6	5,777	1	0.008
	Trawl	Jan-Apr	0.10	1.89	31.61	30.52	23.07	11.01	1.51	0.26	0.03	0.00	130.6	5,777	0	0.000
	Gillnet	Oct-Dec	0.00	0.00	17.41	30.36	37.50	11.16	3.13	0.45	0.00	0.00	133.4	224	6	0.048
19734	Gillnet	Jan-Apr	0.00	0.00	17.41	30.36	37.50	11.16	3.13	0.45	0.00	0.00	133.4	224	2,057	15,421
	Seine	Jan-Apr	0.00	16.29	60.29	17.53	4.19	1.47	0.11	0.11	0.00	0.00	77.8	884	856	11,013
	Seine	May	0.00	16.29	60.29	17.53	4.19	1.47	0.11	0.11	0.00	0.00	77.8	884	82	0.785
	Trawl	Jan-Apr	0.00	16.83	61.15	17.24	3.42	1.23	0.14	0.00	0.00	0.00	72.2	731	5	0.064
	Gillnet	Jan-Apr	0.00	0.00	3.74	43.94	32.01	17.96	3.21	0.43	0.00	0.00	157.1	924	3,085	19,682
	Seine	Oct-Dec	1.00	5.07	54.83	26.49	7.34	3.17	1.50	0.44	0.18	0.00	97.1	5,885	218	2,243
19745	Seine	Jan-Apr	0.36	3.87	57.31	27.60	7.04	2.49	0.77	0.23	0.13	0.00	98.1	5,885	575	5,995
	Seine	May	1.00	5.07	54.83	26.49	7.34	3.17	1.50	0.44	0.18	0.00	97.1	5,885	55	0.564
	Trawl	Oct-Dec	1.00	5.07	54.83	26.49	7.34	3.17	1.50	0.44	0.18	0.00	97.1	5,885	1	0.006
	Gillnet	Jan-Apr	0.00	0.00	4.88	46.34	32.32	12.80	3.05	0.61	0.00	0.00	150.1	164	5,331	35,526
	Seine	Oct-Dec	0.06	7.34	23.01	40.08	20.31	5.57	2.38	0.79	0.43	0.04	122.7	3,494	4,313	35,358
	Seine	Jan-Apr	0.00	5.95	20.35	46.41	19.28	5.46	1.60	0.71	0.20	0.04	109.9	2,254	834	7,186
19756	Seine	May	0.03	7.45	21.69	41.20	20.01	5.53	2.57	1.04	0.40	0.07	119.8	5,748	28	0.238
	Trawl	Oct-Dec	0.03	7.28	21.54	41.65	19.99	5.44	2.59	1.01	0.39	0.07	120.3	5,918	3	0.021
	Trawl	Jan-Apr	0.03	7.28	21.54	41.65	19.99	5.44	2.59	1.01	0.39	0.07	120.3	5,918	86	0.071
	Gillnet	Jan-Apr	0.00	0.00	0.54	42.00	43.88	10.26	2.70	0.40	0.20	0.00	148.8	786	6,975	46,818
	Seine	Oct-Dec	0.62	6.52	56.39	19.55	12.05	3.06	0.95	0.66	0.19	0.01	107.2	1,828	616	5,838
	Seine	Jan-Apr	0.06	3.39	52.68	22.31	16.46	3.70	0.86	0.42	0.03	0.09	105.5	3,200	8,257	78,397
19767	Seine	May	0.36	3.76	52.98	21.04	15.51	4.16	1.25	0.62	0.20	0.12	106.5	5,028	25	0.236
	Trawl	Oct-Dec	0.36	3.76	52.98	21.04	15.51	4.16	1.25	0.62	0.20	0.12	106.5	5,028	73	0.683
	Trawl	Jan-Apr	0.36	3.76	52.98	21.04	15.51	4.16	1.25	0.62	0.20	0.12	106.5	5,028	802	7,534
	Gillnet	Jan-Apr	0.00	0.00	3.50	27.75	47.32	16.68	4.08	0.54	0.15	0.00	150.3	1,658	7,736	51,507
	Seine	Oct-Dec	0.06	2.53	36.75	40.07	9.39	7.18	3.08	0.56	0.35	0.03	117.2	1,984	10,648	96,197
	Seine	Jan-Apr	0.00	0.42	34.65	42.60	13.62	7.09	1.22	0.32	0.00	0.08	125.6	3,516	3,919	36,641
19778	Seine	May	0.06	2.25	36.56	39.10	10.46	7.84	2.83	0.57	0.27	0.05	106.3	5,500	30	0.287
	Trawl	Oct-Dec	0.03	1.31	35.05	42.37	11.19	7.52	1.95	0.34	0.15	0.08	107.9	5,891	1,792	16,618
	Trawl	Jan-Apr	0.03	1.31	35.05	42.37	11.19	7.52	1.95	0.34	0.15	0.08	107.9	5,891	296	2,746
	Gillnet	Oct-Dec	0.00	0.00	0.37	20.33	30.50	36.04	10.91	1.48	0.37	0.00	148.9	541	103	0.425
	Gillnet	Jan-Apr	0.00	0.00	0.37	20.33	30.50	36.04	10.91	1.48	0.37	0.00	148.9	541	7,253	48,694
	Seine	Oct-Dec	0.00	1.62	17.91	38.42	27.23	8.82	4.77	1.01	0.15	0.08	126.5	2,433	10,046	79,075
19789	Seine	Jan-Apr	0.00	3.01	23.91	33.51	25.54	7.92	3.91	1.48	0.43	0.29	117.7	2,095	54	0.461
	Seine	May	0.00	2.25	20.19	36.76	25.68	8.39	4.95	1.27	0.31	0.20	120.8	4,528	71	0.587
	Trawl	Oct-Dec	0.00	1.04	17.08	39.67	29.98	8.28	2.76	1.04	0.07	0.07	125.5	1,341	2,734	21,790
	Trawl	Jan-Apr	0.00	2.34	21.31	33.82	29.30	8.39	3.55	0.56	0.48	0.24	121.0	1,239	607	5,018
	Gillnet	Oct-Dec	0.00	0.00	1.15	23.14	34.68	13.77	5.54	1.53	0.00	0.19	153.5	523	7	0.048
	Gillnet	Jan-Apr	0.00	0.00	1.25	22.00	55.92	14.11	5.74	1.66	0.00	0.21	153.8	523	6,818	44,171
19790	Seine	Oct-Dec	0.30	2.02	42.12	22.71	18.78	9.35	2.56	1.54	0.47	0.15	114.6	3,063	1,188	10,051
	Seine	Jan-Apr	0.00	4.56	41.61	20.44	30.26	8.99	2.55	1.29	0.25	0.05	100.1	7,741	903	0.227
	Seine	May	0.16	4.11	43.38	19.92	19.27	8.70	2.58	1.41	0.37	0.11	102.1	10,804	52	0.515
	Trawl	Oct-Dec	0.00	3.30	46.70	22.21	15.90	8.60	2.01	1.29	0.00	0.00	108.4	698	242	2,234
	Trawl	Jan-Apr	0.00	3.31	49.04	22.17	14.65	7.90	1.78	1.15	0.00	0.00	107.1	785	254	2,373
	Gillnet	Oct-Dec	0.00	0.00	1.52	9.89	44.49	34.22	8.75	0.76	0.38	0.00	148.7	263	0	0.001
19801	Gillnet	Jan-Apr	0.00	0.00	1.52	9.89	44.49	34.22	8.75	0.76	0.38	0.00	148.7	263	3,177	21,367
	Gillnet	May	0.00	0.00	1.52	9.89	44.49	34.22	8.75	0.76	0.38	0.00	148.7	263	2	0.017
	Seine	Oct-Dec	0.00	4.38	33.94	34.26	14.82	8.57	3.14	0.66	0.21	0.02	116.5	6,355	4,152	34,800
	Seine	Jan-Apr	0.00	6.17	34.93	30.73	11.93	10.58	4.58	0.67	0.37	0.04	99.9	12,461	2,133	19,819
	Seine	May	0.00	4.85	38.20	36.20	10.08	7.78	2.24	0.47	0.15	0.03	98.7	18,816	80	0.826
	Trawl	Oct-Dec	0.26	4.38	39.15	29.90	13.16	7.76	3.57	1.13	0.61	0.09	111.0	1,147	501	4,510
19812	Trawl	Jan-Apr	0.26	4.36	39.15	29.90	13.16	7.76	3.57	1.13	0.61	0.09	111.0	1,147	121	1,087
	Gillnet	Jan-Apr	0.00	0.09	2.19	18.15	22.98	37.37	16.05	2.81	0.26	0.09	152.1	1,140	5,067	33,319
	Seine	Oct-Dec	0.00	5.36	39.88	31.35	14.07	4.96	3.31	0.83	0.06	0.06	121.1	3,876	3,337	27,503
	Seine	Jan-Apr	0.00	7.65	37.90	23.33	19.46	4.51	4.57	2.11	0.40	0.06	104.8	5,332	3,324	30,103
	Seine	May	0.00	3.86	35.45	28.47	21.36	4.56	4.30	1.74	0.22	0.04	106.8	9,208	74	0.690
	Trawl	Oct-Dec	0.00	2.19	46.35	30.29	15.51	2.74	1.64	0.91	0.00	0.36	119.5	548	414	3,464
19823	Trawl	Jan-Apr	0.00	2.19	46.35	30.29	15.51	2.74	1.64	0.91	0.00	0.36	119.5	548	101	0.843
	Gillnet	Jan-Apr	0.00	0.00	4.60	15.77	30.37	15.82	20.42	11.58	1.03	0.41	150.9	589	5,583	37,004
	Gillnet	May	0.00	0.00	4.58	15.96	30.56	15.11	20.88	11.71	0.85	0.34	151.6	589	0	0.001
	Seine	Oct-Dec	0.00	3.37	34.06	30.39	16.43	8.12	2.93	3.00	1.43	0.26	116.0	5,296	632	4,809
	Seine	Jan-Apr	0.00	3.36	31.41	28.72	17.68	11.49	3.16	2.78	1.16	0.24	113.5	13,007	7,798	69,556
	Seine	May	0.00	10.91	42.05	22.36	12.44	7.63	1.95	1.76	0.72	0.14	109.6	18,303	57	0.568
19834	Trawl	Oct-Dec	0.00	1.59	19.36	35.99	17.54	12.07	3.87	5.01	3.87	0.68	144.1	439	115	0.797
	Trawl	Jan-Apr	0.00	1.59	19.36	35.99	17.54	12.07	3.87	5.01	3.87	0.68	144.1	439	0	0.000
	Trawl	May	0.00	1.59	19.36	35.99	17.54	12.07	3.87	5.01	3.87	0.68	144.1	439	2	0.017
	Gillnet	Jan-Apr	0.00	0.00	0.49	27.76	29.48	23.59	9.34	7.37	1.72	0.23	152.8	407	8,613	56,381
	Seine	Oct-Dec	0.21	19.24	36.34	21.19	13.02	6.01	2.80	0.64	0.34	0.22	108.4	3,634	444	3,882
	Seine	Jan-Apr	0.00	4.70	40.35	31.85	11.86	6.31	3.10	1.27	0.44	0.11	103.8	7,318	4,137	41,058
19845	Seine	May	0.15	10.57	39.21	27.00	12.16	6.30	3.13	0.95	0.39	0.14	105.9	10,952	86	0.843
	Trawl	Oct-Dec	0.12	11.35	38.18	26.45	12.59	6.62	3.17	0.95	0.41	0.16	106.6	10,952	113	1,056
	Trawl	Jan-Apr	0.12	11.35	38.18	26.45	12.59	6.62	3.17	0.95	0.41	0.16	106.6	10,952	214	2,011
	Gillnet	Jan-Apr	0.00	0.00	7.14	30.29	30.95	19.05	9.39	1.59	0.66	0.93	142.9	756	6,039	42,348
	Seine	Oct-Dec	0.00	32.93	37.34	18.72	6.75	2.89	0.91	0.34	0.11	0.00	101.9	9,528	409	3,904
	Seine	Jan-Apr	0.00	23.09	43.51</											

Table 1.4. Age composition and catch by season, fishery and gear type for the Strait of Georgia stock assessment region. Percentages represent a combination of samples taken from commercial fisheries and pre-fishery charters. Age-9+ represents the plus group of ages.

Season	Gear	Fishery	PERCENT AT AGE										Mean Weight	Number Aged	CATCH		
			0+	1+	2+	3+	4+	5+	6+	7+	8+	9+			(tonnes)	(millions)	
19845	Seine	May	0.00	24.05	45.04	18.72	7.69	2.83	1.19	0.42	0.05	0.01	90.3	10,715	+	88	0.975
	Trawl	Oct-Dec	0.00	25.68	43.11	18.61	7.60	3.21	1.20	0.51	0.06	0.01	93.7	10,799	+	20	0.218
	Trawl	Jan-Apr	0.00	25.68	43.11	18.61	7.60	3.21	1.20	0.51	0.06	0.01	93.7	10,799	+	246	2.630
	Gillnet	Oct-Dec	0.00	0.09	3.10	26.09	32.48	23.83	9.22	3.74	0.82	0.82	147.4	1,096	+	0	0.002
	Gillnet	Jan-Apr	0.00	0.09	3.10	26.09	32.48	23.83	9.22	3.74	0.82	0.82	147.4	1,096	+	3,495	23,718
19856	Seine	Oct-Dec	0.00	14.33	62.24	17.57	4.40	1.27	0.17	0.02	0.00	0.00	103.3	1,380	+	209	2,304
	Seine	Jan-Apr	0.01	9.76	55.76	24.58	6.45	2.06	0.80	0.12	0.08	0.00	94.7	6,773	+	178	1,844
	Seine	May	0.05	13.71	56.73	21.10	5.75	1.79	0.70	0.12	0.06	0.00	95.2	8,163	+	40	0.426
	Trawl	Oct-Dec	0.05	13.71	56.73	21.10	5.75	1.79	0.70	0.12	0.06	0.00	95.2	8,163	+	46	0.481
	Trawl	Jan-Apr	0.05	13.71	56.73	21.10	5.75	1.79	0.70	0.12	0.06	0.00	95.2	8,163	+	120	1,257
19867	Gillnet	Oct-Dec	0.00	0.00	2.50	35.82	33.44	16.51	8.49	2.60	0.57	0.26	145.1	1,920	+	0	0.000
	Seine	Oct-Dec	0.10	23.34	34.77	30.50	8.84	1.75	0.46	0.23	0.00	0.00	104.8	1,148	+	104	0.984
	Seine	Jan-Apr	0.03	2.73	32.98	33.23	19.76	4.32	1.22	0.45	0.19	0.10	97.6	7,957	+	3,133	32,258
	Seine	May	0.03	11.92	35.91	34.11	13.52	3.16	0.96	0.27	0.08	0.05	94.2	9,105	+	41	0.431
	Trawl	Jan-Apr	0.03	11.92	33.27	35.95	14.21	3.23	0.99	0.34	0.11	0.05	98.6	9,105	+	76	0.768
19878	Gillnet	Jan-Apr	0.00	0.00	3.01	38.33	32.48	15.47	7.35	2.55	0.60	0.21	145.3	1,920	+	5,995	41,166
	Seine	Oct-Dec	0.41	6.52	64.47	14.59	11.38	1.81	0.55	0.15	0.11	0.00	106.4	1,632	+	357	3,386
	Seine	Jan-Apr	0.00	2.35	52.89	17.58	20.29	5.27	1.31	0.21	0.10	0.00	104.0	8,338	+	1,475	13,518
	Seine	May	0.07	4.82	61.80	14.59	13.89	3.51	0.87	0.18	0.06	0.00	99.7	7,970	+	33	0.333
	Trawl	Oct-Dec	0.06	4.74	61.47	14.71	14.27	3.60	0.90	0.19	0.06	0.00	100.5	7,970	+	83	0.826
19889	Trawl	Jan-Apr	0.06	4.74	61.47	14.71	14.27	3.60	0.90	0.19	0.06	0.00	100.5	7,970	+	279	2,773
	Gillnet	Jan-Apr	0.00	0.00	9.20	14.81	47.81	20.09	5.27	2.24	0.34	0.22	144.4	891	+	5,988	41,461
	Seine	Oct-Dec	0.00	26.15	17.44	42.75	6.77	5.90	0.82	0.16	0.00	0.00	109.1	1,252	+	728	6,660
	Seine	Jan-Apr	0.00	12.31	15.17	51.91	10.87	7.93	1.48	0.27	0.04	0.03	104.6	6,517	+	1,446	13,339
	Seine	May	0.01	12.64	17.97	51.78	8.95	6.86	1.47	0.28	0.03	0.01	102.2	7,769	+	56	0.547
19890	Trawl	Oct-Dec	0.01	12.64	17.97	51.78	8.95	6.86	1.47	0.28	0.03	0.01	102.2	7,769	+	134	1,308
	Trawl	Jan-Apr	0.00	0.00	1.60	40.43	21.42	26.02	7.99	2.26	0.28	0.00	140.3	823	+	5,919	42,236
	Seine	Oct-Dec	0.00	6.68	58.62	12.72	17.67	2.26	2.05	0.00	0.00	0.00	101.3	928	+	75	0.736
	Seine	Jan-Apr	0.00	10.95	57.87	8.23	17.43	3.59	2.27	0.40	0.07	0.06	100.2	5,915	+	96	0.936
	Seine	May	0.00	7.51	56.71	11.25	19.33	2.97	1.81	0.34	0.06	0.01	97.4	6,843	+	82	0.632
19901	Gillnet	Jan-Apr	0.00	0.00	8.93	11.71	56.04	12.10	9.44	1.41	0.30	0.06	141.6	1,371	+	7,886	55,630
	Seine	Oct-Dec	0.00	13.89	31.24	38.58	7.67	7.42	1.04	0.16	0.00	0.00	107.5	698	+	371	3,440
	Seine	Jan-Apr	0.00	3.82	21.09	44.52	10.27	16.08	2.48	1.47	0.24	0.03	109.4	5,291	+	1,141	10,217
	Seine	May	0.00	10.74	23.31	39.87	8.80	13.78	2.05	1.27	0.17	0.02	106.1	5,989	+	58	0.541
	Trawl	Oct-Dec	0.00	10.74	23.31	39.87	8.80	13.78	2.05	1.27	0.17	0.02	106.1	5,989	+	122	1,133
19912	Gillnet	Jan-Apr	0.00	0.00	1.29	28.15	17.20	40.11	7.27	4.69	1.20	0.09	146.0	1,087	+	8,410	64,461
	Seine	Oct-Dec	0.00	4.17	70.00	15.28	8.56	1.12	0.45	0.45	0.00	0.00	102.5	890	+	916	8,886
	Seine	Jan-Apr	0.00	3.62	53.63	14.96	17.44	4.04	5.34	0.59	0.38	0.00	105.6	5,036	+	3,725	34,318
	Seine	May	0.00	4.96	57.49	13.77	15.39	3.10	4.44	0.56	0.27	0.02	103.9	5,926	+	57	0.551
	Trawl	Oct-Dec	0.00	4.96	57.49	13.77	15.39	3.10	4.44	0.56	0.27	0.02	103.9	5,926	+	128	1,231
19923	Gillnet	Jan-Apr	0.00	0.00	6.33	14.88	43.63	11.72	18.91	2.65	1.45	0.43	147.6	1,169	+	8,870	60,081
	Seine	Oct-Dec	0.00	26.85	31.11	31.47	6.97	2.56	0.26	0.58	0.11	0.00	98.6	973	+	516	5,272
	Seine	Jan-Apr	0.00	11.22	39.18	33.15	7.57	5.77	1.37	1.63	0.06	0.06	101.3	5,580	+	4,396	42,070
	Seine	May	0.00	16.84	36.82	31.52	8.85	5.40	1.21	1.38	0.14	0.03	99.5	6,513	+	96	0.969
	Gillnet	Jan-Apr	0.00	0.00	11.47	40.02	16.98	21.61	4.06	5.40	0.22	0.22	137.9	907	+	8,733	63,326
19934	Seine	Oct-Dec	0.00	5.53	51.43	24.01	14.52	1.61	0.90	0.00	0.00	0.00	99.0	558	+	957	9,662
	Seine	Jan-Apr	0.02	3.72	42.96	26.98	19.34	3.70	2.65	0.53	0.13	0.00	97.2	5,969	+	5,138	52,868
	Seine	May	0.02	4.92	42.98	26.47	18.40	3.78	2.65	0.64	0.14	0.00	97.3	6,527	+	71	0.732
	Gillnet	Jan-Apr	0.00	0.07	3.65	25.26	44.78	15.21	7.83	2.42	0.62	0.16	133.7	1,201	+	11,572	86,661
	Seine	Oct-Dec	0.00	20.87	27.61	36.05	10.01	4.44	0.68	0.11	0.00	0.02	102.9	1,130	+	604	5,865
19945	Seine	Jan-Apr	0.00	7.09	21.21	37.04	18.67	11.51	2.92	1.13	0.35	0.08	109.9	5,754	+	4,362	38,991
	Seine	May	0.00	11.65	22.69	35.99	16.39	9.89	2.37	0.93	0.29	0.10	107.9	6,884	+	35	0.326
	Gillnet	Jan-Apr	0.00	0.00	2.10	27.92	38.15	24.14	5.10	2.10	0.30	0.30	139.6	927	+	8,190	58,655
	Seine	Oct-Dec	0.49	29.31	46.92	11.70	8.84	1.78	0.87	0.08	0.00	0.00	95.9	1,662	+	347	4,650
	Seine	Jan-Apr	0.06	9.29	47.72	15.20	15.88	6.74	3.87	0.86	0.27	0.11	98.2	8,243	+	7,434	73,620
19956	Seine	May	0.08	14.92	48.51	13.72	13.62	5.27	3.01	0.61	0.19	0.07	95.1	9,905	+	10	0.106
	Trawl	Oct-Dec	0.08	14.92	48.51	13.72	13.62	5.27	3.01	0.61	0.19	0.07	95.1	9,905	+	39	0.406
	Gillnet	Jan-Apr	0.00	0.00	4.05	19.87	44.53	22.08	10.30	2.11	0.84	0.21	138.2	544	+	6,233	45,214
	Seine	Oct-Dec	3.29	5.71	54.01	21.40	5.31	5.27	2.24	1.24	0.14	0.16	88.1	7,687	+	279	3,120
	Seine	Jan-Apr	0.00	5.52	51.35	24.45	6.54	7.43	2.84	1.70	0.12	0.04	88.8	7,297	+	9,390	96,287
19967	Seine	May	0.65	8.74	52.26	22.45	5.78	6.09	2.41	1.42	0.13	0.07	91.7	7,667	+	7	0.071
	Gillnet	Jan-Apr	0.00	0.00	4.74	17.85	18.43	31.91	17.06	8.53	2.53	0.95	136.7	633	+	6,148	44,974
	Seine	Oct-Dec	0.00	3.96	48.07	40.23	9.40	0.91	0.34	0.08	0.00	0.00	86.1	1,288	+	954	11,072
	Seine	Jan-Apr	0.02	2.93	47.03	31.80	12.25	2.90	2.14	0.70	0.21	0.03	86.8	5,837	+	5,755	66,260
	Trawl	Jan-Apr	0.00	7.01	45.19	37.03	8.16	1.14	0.98	0.16	0.33	0.00	74.3	613	+	0	0.000
19978	Gillnet	Jan-Apr	0.00	0.00	2.10	28.16	29.30	14.83	17.07	6.12	1.64	0.79	125.7	1,388	+	9,785	75,940
	Seine	Oct-Dec	0.17	12.30	27.77	43.17	13.35	2.74	0.37	0.13	0.00	0.00	91.3	1,287	+	1,471	16,123
	Seine	Jan-Apr	0.00	4.23	22.78	45.02	18.55	6.58	1.88	0.78	0.13	0.06	100.0	3,162	+	4,976	49,748
	Trawl	Jan-Apr	0.00	5.49	31.87	30.77	21.98	7.69	1.10	0.00	1.10	0.00	92.3	91	+	0	0.000
	Gillnet	Jan-Apr	0.00	0.00	2.15	29.31	36.72	21.05	6.70	3.35	0.60	0.12	130.8	836	+	6,863	52,450
19989	Seine	Oct-Dec	0.00	21.12	50.16	16.69	8.74	2.39	0.89	0.00	0.00	0.00	75.0	1,077	+	1,156	15,363
	Seine	Jan-Apr	0.10	9.62	55.48	19.34	23.92	8.61	2.12	0.36	0.28	0.02	92.2	5,042	+	6,454	69,961
	Gillnet	Jan-Apr	0.00	0.00	1.08	14.00	44.71	28.42	9.40	1.99	0.39	0.02	134.3	1,159	+	7,594	56,373
	Seine	Oct-Dec	0.00	0.66	81.94	27.98	5.82	3.51	1.25	0.00	0.13	0.00	98.6	630	+	1,423	13,541
	Seine	Jan-Apr															

Table 1.4. Age composition and catch by season, fishery and gear type for the Strait of Georgia stock assessment region. Percentages represent a combination of samples taken from commercial fisheries and pre-fishery charters. Age-9++ represents the plus group of ages.

Season	Gear	Fishery	P E R C E N T A T A G E										Mean Weight	Number Aged	C A T C H	
			0+	1+	2+	3+	4+	5+	6+	7+	8+	9++			(tonnes)	(millions)
20023	Seine	Oct-Dec	0.00	2.80	44.16	42.29	8.41	2.10	0.23	0.00	0.00	0.00	91.9	428	1.696	16.466
	Seine	Jan-Apr	0.01	2.57	42.82	36.58	12.64	4.03	0.93	0.41	0.10	0.00	87.2	7,293	10.600	121.507
	Gillnet	Jan-Apr	0.00	0.00	2.29	22.23	31.51	23.72	9.98	7.15	2.55	0.57	131.1	1,311	8.083	61.493
20034	Seine	Oct-Dec	0.00	11.24	30.77	40.04	14.00	3.55	0.39	0.00	0.00	0.00	83.1	507	1.356	16.316
	Seine	Jan-Apr	0.00	2.90	25.39	41.55	22.29	5.65	1.54	0.43	0.25	0.00	83.1	1,707	7.019	79.434
	Gillnet	Jan-Apr	0.00	0.00	1.73	21.37	37.01	23.99	11.75	2.51	1.49	0.14	124.0	1,185	5.226	41.623
20045	Seine	Oct-Dec	0.05	9.02	31.32	28.33	20.85	7.92	1.94	0.44	0.10	0.03	87.7	5,135	1.332	15.157
	Seine	Jan-Apr	0.00	4.00	23.82	31.66	28.26	8.73	2.30	0.85	0.28	0.09	95.6	3,174	7.929	82.945
	Gillnet	Jan-Apr	0.00	0.00	0.79	12.47	46.19	25.12	10.31	3.68	1.26	0.16	131.1	773	8.954	68.338
20056	Seine	Oct-Dec	0.33	23.95	30.75	23.55	11.93	7.30	1.88	0.83	0.31	0.01	79.5	4,891	1.371	17.913
	Seine	Jan-Apr	0.07	17.00	24.96	24.50	18.89	11.01	2.44	0.88	0.21	0.03	80.8	4,195	9.308	110.245
	Gillnet	Jan-Apr	0.00	0.00	0.69	12.90	33.91	33.26	15.08	3.24	0.85	0.08	129.8	810	7.277	56.068
20067	Seine	Oct-Dec	0.00	2.66	48.04	26.57	12.82	5.96	3.01	0.68	0.23	0.03	84.9	6,122	6.72	7.770
	Seine	Jan-Apr	0.00	1.71	48.41	27.08	12.84	5.93	3.12	0.71	0.20	0.02	83.9	5,809	3.865	45.134
	Gillnet	Jan-Apr	0.00	0.00	4.80	13.95	28.09	27.34	19.06	5.14	1.36	0.26	125.2	2,645	5.286	42.169
20078	Seine	Oct-Dec	0.12	18.45	10.56	55.82	14.50	2.89	0.81	0.12	0.12	0.00	74.8	933	1.136	14.517
	Seine	Jan-Apr	0.00	0.25	7.14	65.12	16.73	6.27	3.01	1.20	0.25	0.04	88.0	2,761	6.046	68.731
	Gillnet	Jan-Apr	0.00	0.01	1.24	41.78	23.94	17.99	10.43	3.29	1.28	0.05	111.0	1,866	2.752	24.624
20089	Seine	Oct-Dec	0.00	0.69	73.58	15.82	7.88	1.64	0.29	0.09	0.01	0.00	65.0	4,964	547	8.708
	Seine	Jan-Apr	0.00	0.47	66.60	14.39	12.67	4.08	1.15	0.40	0.24	0.00	74.8	2,967	5.685	76.005
	Gillnet	Jan-Apr	0.00	0.00	4.79	7.18	53.14	18.93	11.29	3.31	1.25	0.11	122.7	877	3.937	32.095

NOTE: \* No biosample data available. Age composition and mean weight assigned from published reports.

+ Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods, by gear type.

- No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter.

Table 1.5. Age composition and catch by season, fishery and gear type for the West Coast Vancouver Island stock assessment region. Percentages represent a combination of samples taken from commercial fisheries and pre-fishery charters. Age-9+ represents the plus group of ages.

Season	Gear	Fishery	PERCENT BY AGE										Mean Weight	Number Aged	CATCH	
			0+	1+	2+	3+	4+	5+	6+	7+	8+	9+			(tonnes)	(millions)
19501	Seine	Oct-Dec	0.10	15.78	39.08	37.78	5.35	1.56	0.26	0.05	0.05	0.00	96.8	1 927	7 670	79 266
	Seine	Jan-Apr	0.00	10.19	36.69	43.89	7.69	1.25	0.30	0.00	0.00	0.00	99.3	2 112	14 151	143 353
19512	Seine	Oct-Dec	0.11	6.62	61.99	20.85	9.27	0.89	0.27	0.00	0.00	0.00	98.9	996	8 251	83 215
	Seine	Jan-Apr	0.00	0.33	12.08	27.32	50.77	6.88	2.08	0.48	0.06	0.00	123.8	3 897	18 757	146 019
19523	Seine	Jan-Apr	0.16	11.77	57.76	28.08	1.67	0.50	0.05	0.00	0.00	0.00	82.4	3 764	20	0 242
19534	Seine	Oct-Dec	0.05	1.61	61.40	29.42	6.70	0.59	0.12	0.12	0.00	0.00	95.6	3 655	23 534	245 938
	Seine	Jan-Apr	0.00	4.43	65.53	24.61	4.06	0.83	0.21	0.04	0.04	0.04	87.2	2 439	9 675	109 814
19545	Seine	Oct-Dec	0.06	19.64	57.81	18.59	3.27	0.64	0.00	0.00	0.00	0.00	87.6	1 723	4 650	53 117
	Seine	Jan-Apr	0.00	10.86	68.09	20.01	4.47	0.52	0.08	0.00	0.00	0.00	80.9	754	1 473	18 369
19556	Seine	Oct-Dec	0.00	13.43	67.98	14.82	3.09	0.50	0.16	0.02	0.00	0.00	87.4	3 730	15 310	175 972
	Seine	Jan-Apr	0.00	9.21	49.51	19.28	17.88	3.68	0.11	0.11	0.22	0.00	87.2	923	1 787	20 496
19567	Seine	Oct-Dec	0.00	2.86	71.84	24.69	0.41	0.20	0.00	0.00	0.00	0.00	86.4	490 +	1 690	19 549
	Seine	Jan-Apr	0.00	2.74	71.92	24.81	0.35	0.18	0.00	0.00	0.00	0.00	86.4	588 +	915	10 586
	Seine	May	0.00	2.72	71.94	24.83	0.34	0.17	0.00	0.00	0.00	0.00	86.4	588 +	8	0 088
19578	Seine	Jan-Apr	0.00	15.18	54.28	25.87	3.98	0.47	0.17	0.04	0.01	0.00	76.8	1 480	513	6 766
	Seine	May	0.00	13.04	52.03	25.41	5.47	2.30	1.35	0.34	0.07	0.00	78.3	1 480 +	43	0 551
19589	Seine	Oct-Dec	0.00	3.26	45.21	29.96	14.51	3.46	1.82	1.45	0.33	0.00	92.2	2 843	55 196	588 911
	Seine	Jan-Apr	0.00	3.28	19.68	23.88	26.94	9.15	7.94	6.52	1.99	0.62	99.6	751	13 845	136 204
	Gillnet	Jan-Apr	0.00	10.00	58.10	9.50	19.00	2.60	0.50	0.20	0.10	0.00	97.6	0 *	182	1 868
19590	Seine	Oct-Dec	0.00	8.92	54.85	23.26	8.64	2.81	0.95	0.35	0.14	0.07	95.7	2 846	53 911	563 328
	Seine	Jan-Apr	0.00	8.92	54.85	23.26	8.64	2.81	0.95	0.35	0.14	0.07	95.7	2 846	0	0 000
19601	Seine	Oct-Dec	0.00	38.31	37.97	19.15	4.41	0.17	0.00	0.00	0.00	0.00	85.5	590 +	16 711	195 386
	Seine	Jan-Apr	0.00	38.31	37.97	19.15	4.41	0.17	0.00	0.00	0.00	0.00	85.5	590 +	9 679	113 162
	Seine	May	0.00	38.31	37.97	19.15	4.41	0.17	0.00	0.00	0.00	0.00	85.5	590 +	44	0 520
19612	Seine	Oct-Dec	0.00	4.82	82.29	9.63	2.41	0.86	0.00	0.00	0.00	0.00	93.2	1 163 +	5 951	63 821
	Seine	Jan-Apr	0.00	5.32	80.46	10.07	3.10	1.05	0.00	0.00	0.00	0.00	92.8	1 117	17 710	190 890
	Trawl	Jan-Apr	0.00	4.82	82.29	9.63	2.41	0.86	0.00	0.00	0.00	0.00	93.2	1 163 +	24	0 253
19623	Seine	Oct-Dec	0.00	1.99	43.18	48.71	5.16	0.75	0.21	0.00	0.00	0.00	101.3	1 862 +	3 184	31 449
	Seine	Jan-Apr	0.00	2.47	41.39	49.75	5.41	0.71	0.27	0.00	0.00	0.00	101.0	1 633	15 022	148 723
19634	Seine	Oct-Dec	0.00	1.64	60.61	25.86	10.83	0.77	0.29	0.00	0.00	0.00	103.4	1 107 +	2 952	28 550
	Seine	Jan-Apr	0.00	0.95	65.05	22.91	10.00	0.85	0.25	0.00	0.00	0.00	101.0	769	18 313	182 208
19645	Seine	Oct-Dec	0.00	2.78	34.38	48.44	10.07	3.99	0.35	0.00	0.00	0.00	122.5	576 +	68	0 553
	Seine	Jan-Apr	0.00	2.78	34.37	48.44	10.07	3.99	0.35	0.00	0.00	0.00	122.5	576	10 397	84 858
	Seine	May	0.00	2.78	34.37	48.44	10.07	3.99	0.35	0.00	0.00	0.00	122.5	576 +	5 582	45 559
19656	Seine	Oct-Dec	0.00	13.59	26.83	26.12	23.17	9.07	1.23	0.00	0.00	0.00	137.0	0 *	4 299	31 377
	Seine	Jan-Apr	0.00	13.59	26.83	26.12	23.17	9.07	1.23	0.00	0.00	0.00	137.0	0 *	5 471	47 228
	Seine	May	0.00	13.59	26.83	26.12	23.17	9.07	1.23	0.00	0.00	0.00	137.0	0 *	73	0 535
19667	Seine	Oct-Dec	0.00	12.86	60.28	20.52	4.84	1.15	0.18	0.01	0.02	0.00	114.9	0 *	2 965	25 811
	Seine	Jan-Apr	0.00	12.86	60.28	20.52	4.84	1.15	0.18	0.01	0.02	0.00	114.9	0 *	9 794	85 253
	Seine	May	0.00	12.86	60.28	20.52	4.84	1.15	0.18	0.01	0.02	0.00	114.9	0 *	2 385	20 760
19701	Seine	Jan-Apr	0.00	5.77	44.57	36.95	7.85	2.77	1.62	0.46	0.00	0.00	132.8	433	0	0 000
19712	Seine	Jan-Apr	0.00	3.66	19.01	50.10	21.81	3.39	1.23	0.79	0.03	0.00	135.3	1 482	6 894	51 001
19723	Seine	Jan-Apr	0.00	0.21	25.15	23.05	35.64	13.81	1.89	0.17	0.08	0.00	139.1	2 556	16 766	117 326
	Gillnet	Jan-Apr	0.00	0.00	8.81	23.56	51.44	12.23	3.06	0.72	0.18	0.00	159.4	556	1 537	9 642
19734	Seine	Jan-Apr	0.00	5.71	43.66	22.09	15.14	10.96	2.32	0.12	0.00	0.00	114.9	5 221	12 394	109 083
	Gillnet	Jan-Apr	0.00	0.00	29.87	27.92	27.92	10.39	3.90	0.00	0.00	0.00	133.5	154 +	3 940	29 517
19745	Seine	Jan-Apr	0.02	0.44	51.61	19.95	12.00	8.70	5.71	1.38	0.18	0.00	124.6	10 038	17 798	142 327
	Trawl	Jan-Apr	0.02	0.60	53.85	19.75	11.36	8.01	4.96	1.28	0.17	0.01	122.5	10 038 +	0	0 004
	Gillnet	Jan-Apr	0.00	0.00	2.90	32.37	30.51	19.92	7.88	0.41	0.00	0.00	169.0	241 +	8 310	49 159
19756	Seine	Jan-Apr	0.00	0.20	8.31	48.06	19.79	12.97	7.65	2.57	0.43	0.00	140.0	9 230	22 820	162 893
	Trawl	Jan-Apr	0.00	0.47	14.55	54.46	18.78	6.10	5.16	0.47	0.00	0.00	131.6	213	0	0 000
	Gillnet	Jan-Apr	0.00	0.00	0.68	41.72	34.00	14.77	5.92	2.50	0.33	0.08	150.2	1 199	16 005	106 418
19767	Seine	Jan-Apr	0.00	0.39	11.51	32.16	38.00	12.43	3.89	1.42	0.16	0.03	136.7	6 684	17 463	126 700
	Gillnet	Jan-Apr	0.00	0.60	3.61	17.47	43.37	16.87	11.14	5.12	1.51	0.30	154.2	332 +	12 556	81 452
	Gillnet	May	0.00	0.60	3.61	17.47	43.37	16.87	11.14	5.12	1.51	0.30	154.2	332 +	24	0 154
19778	Seine	Oct-Dec	0.00	0.00	31.00	23.75	15.00	22.50	4.25	1.50	1.00	1.00	127.3	400	303	2 379
	Seine	Jan-Apr	0.00	0.77	39.43	18.78	16.78	18.80	4.14	1.10	0.17	0.04	109.2	7 454	7 615	67 761
	Seine	May	0.00	0.80	41.49	19.07	15.66	17.60	3.85	1.18	0.23	0.11	111.9	7 854 +	7	0 066
	Trawl	Oct-Dec	0.00	0.80	41.63	19.02	15.66	17.52	3.85	1.18	0.23	0.11	111.8	7 898 +	51	0 456
19778	Trawl	Jan-Apr	0.00	0.80	41.63	19.02	15.66	17.52	3.85	1.18	0.23	0.11	111.8	7 898 +	3	0 023
	Trawl	May	0.00	0.80	41.63	19.02	15.66	17.52	3.85	1.18	0.23	0.11	111.8	7 898 +	11	0 101
	Gillnet	Jan-Apr	0.00	0.00	1.42	5.45	21.33	49.05	17.54	4.74	0.24	0.24	157.6	422	14 755	93 615
19789	Seine	Oct-Dec	0.00	0.81	13.91	50.09	14.23	10.79	7.94	1.60	0.52	0.11	124.5	3 689 +	70	0 563
	Seine	Jan-Apr	0.00	1.07	14.94	51.51	13.82	9.87	7.04	1.43	0.26	0.06	123.1	3 689 +	10 473	86 211
	Seine	May	0.00	0.81	13.91	50.09	14.23	10.79	7.94	1.60	0.52	0.11	124.5	3 689 +	4	0 032
	Trawl	Oct-Dec	0.00	0.81	13.91	50.09	14.23	10.79	7.94	1.60	0.52	0.11	124.5	3 689 +	9	0 073
	Gillnet	Jan-Apr	0.00	0.00	1.05	24.79	28.57	23.74	18.07	3.15	0.42	0.21	161.5	476	8 138	50 388
19790	Seine	Jan-Apr	0.00	7.13	37.93	13.75	20.24	8.99	8.11	3.14	0.48	0.23	110.8	3 735	1 682	14 641
	Seine	May	0.00	6.21	43.91	15.58	20.30	6.37	5.30	2.20	0.35	0.08	108.2	3 735 +	0	0 000
	Gillnet	Jan-Apr	0.00	0.00	0.00	5.31	52.51	22.35	12.01	7.26	0.28	0.28	163.6	358 +	2 300	14 061
19801	Seine	Jan-Apr	0.00	3.89	32.52	33.31	10.62	13.65	4.07	1.51	0.37	0.05	116.1	5 026	5 008	44 277
	Seine	May	0.00	2.83	27.39	22.26	14.13	17.84	8.83	4.77	1.41	0.53	133.6	566	2	0 015
	Gillnet	Jan-Apr	0.00	0.00	1.78	21.00	14.95	36.30	18.86	7.12	0.00	0.00	148.6	281 +	3 079	29 725
19812	Seine	Jan-Apr	0.00	4.32	24.84	28.55	22.53	5.50	7.92	3.73	2.04	0.58	120.4	4 775	2 370	19 713
	Seine	May	0.00	3.27	23.96	27.41	26.05	5.45	9.51	2.72	1.36	0.27	115.9	4 775 +	2	0 013
	Gillnet	Jan-Apr	0.00	0.00	0.70	12.02	44.25	11.67	27.53	3.31	0.35	0.17	137.0</			

Table 1.5. Age composition and catch by season, fishery and gear type for the West Coast Vancouver Island stock assessment region. Percentages represent a combination of samples taken from commercial fisheries and pre-fishery charters. Age-9++ represents the plus group of ages.

Season	Gear	Fishery	PERCENT AT AGE										Mean Weight	Number Aged	CATCH	
			0+	1+	2+	3+	4+	5+	6+	7+	8+	9++			(tonnes)	(millions)
19845	Seine	Jan-Apr	0.00	6.28	48.74	22.86	6.40	5.12	6.21	3.47	0.37	0.55	120.1	2,995	177	1,352
	Seine	May	0.00	20.47	53.62	14.22	3.71	2.74	3.17	1.70	0.13	0.23	109.0	2,995 +	1	0.008
19856	Seine	Oct-Dec	0.00	3.78	50.45	29.70	8.29	3.13	2.24	1.76	0.58	0.07	121.5	4,151 +	1	0.005
	Seine	Jan-Apr	0.00	3.86	48.16	27.50	10.68	3.83	2.92	2.21	0.74	0.11	124.3	2,847	203	1,633
19867	Seine	Jan-Apr	0.00	16.21	16.21	36.29	18.16	7.70	2.56	1.38	1.15	0.34	130.8	3,480	13,463	102,956
	Trawl	Jan-Apr	0.00	26.98	26.03	28.57	13.65	1.59	0.95	1.90	0.32	0.00	93.9	315	0	0.000
	Gillnet	Jan-Apr	0.00	0.00	1.82	24.55	61.82	5.45	2.18	2.91	0.91	0.36	171.3	550	2,471	14,431
19878	Seine	Jan-Apr	0.00	1.60	63.60	7.41	14.70	8.38	2.75	0.65	0.48	0.23	127.5	4,883	8,276	67,129
	Trawl	Jan-Apr	0.00	3.03	59.09	19.70	15.15	3.03	0.00	0.00	0.00	0.00	92.9	66	0	0.000
	Gillnet	Jan-Apr	0.00	0.00	5.38	7.10	41.29	28.60	12.90	3.01	1.29	0.43	166.9	465	1,448	8,674
19889	Seine	Jan-Apr	0.00	3.06	14.96	81.92	7.11	8.47	3.45	0.79	0.17	0.07	126.4	4,178	9,774	77,304
	Trawl	Jan-Apr	0.00	0.00	14.29	63.10	10.71	9.52	2.38	0.00	0.00	0.00	127.4	84	0	0.000
	Gillnet	Jan-Apr	0.00	0.00	0.20	54.50	11.00	22.30	9.40	1.60	1.00	0.00	151.0	382 +	3,515	23,274
19890	Seine	Jan-Apr	0.00	0.46	26.32	11.72	48.79	4.89	5.99	1.53	0.27	0.03	139.4	3,720	7,890	56,611
	Gillnet	Jan-Apr	0.00	0.00	1.35	7.87	58.98	8.31	10.34	2.47	0.67	0.00	155.6	445	1,959	12,593
19901	Seine	Jan-Apr	0.00	6.15	19.13	22.02	10.60	35.06	2.99	3.39	0.64	0.02	130.8	5,715	6,299	47,096
	Gillnet	Jan-Apr	0.00	0.00	3.26	6.84	12.70	64.50	6.84	8.14	6.52	0.00	175.5	307 +	2,336	13,308
19912	Seine	Jan-Apr	0.00	1.47	43.29	10.77	14.97	6.62	18.95	2.42	1.26	0.26	132.2	4,290	3,086	23,337
	Trawl	Jan-Apr	0.00	3.45	31.03	20.69	26.44	2.30	10.34	2.30	2.30	1.15	105.6	87	0	0.000
	Gillnet	Jan-Apr	0.00	0.00	6.29	13.49	30.76	13.85	29.86	2.88	2.52	0.36	154.2	556	627	4,066
19923	Seine	Jan-Apr	0.00	3.46	26.25	39.83	7.14	8.29	4.57	8.71	1.08	0.66	126.9	4,705	5,612	44,244
19934	Seine	Jan-Apr	0.00	3.85	18.47	22.30	31.82	8.69	6.19	6.58	1.84	0.27	125.3	6,196	5,332	42,481
	Trawl	Oct-Dec	0.00	3.00	22.74	24.13	30.04	8.00	5.00	5.26	1.56	0.24	124.7	8,274 +	0	0.001
	Trawl	Jan-Apr	0.00	6.41	25.64	37.18	12.62	12.62	3.85	0.00	1.28	0.00	92.4	78	0	0.000
	Trawl	May	0.00	0.78	26.11	29.11	26.58	7.91	5.38	2.85	1.11	0.16	97.1	632	1	0.008
	Gillnet	Jan-Apr	0.00	0.16	5.85	32.10	54.84	5.32	1.13	0.65	0.16	0.00	131.1	620	706	5,381
19945	Seine	Jan-Apr	0.00	1.02	13.98	21.55	19.83	27.32	7.46	4.66	3.26	0.93	139.0	5,392	1,947	14,006
	Trawl	Oct-Dec	0.00	1.17	13.32	25.60	20.52	25.29	6.44	4.02	2.89	0.75	135.6	7,086 +	1	0.005
	Trawl	May	0.00	2.57	34.57	26.07	10.02	13.75	4.52	3.93	1.57	0.00	105.9	574	3	0.029
19956	Seine	Jan-Apr	0.00	17.06	22.43	12.83	15.22	12.76	14.03	3.39	1.42	0.86	119.3	5,394	790	6,607
	Trawl	Oct-Dec	0.00	14.66	22.14	12.66	19.38	12.53	13.75	2.82	1.25	0.81	119.5	8,255 +	1	0.006
	Trawl	May	0.00	14.66	22.14	12.66	19.38	12.53	13.75	2.82	1.25	0.81	119.5	8,255 +	0	0.000
19967	Seine	Jan-Apr	0.00	3.65	70.44	8.47	4.17	5.11	4.02	3.18	0.63	0.32	98.6	6,539	6,656	67,506
19978	Seine	Jan-Apr	0.00	2.40	21.91	61.07	6.56	2.75	2.40	1.65	0.98	0.29	99.1	6,098	5,449	55,784
	Gillnet	Jan-Apr	0.00	0.00	0.73	40.09	10.72	10.19	16.92	12.39	6.06	2.90	138.6	899	2,633	18,989
19989	Seine	Jan-Apr	0.00	1.39	21.95	23.61	39.60	8.41	2.67	1.29	0.73	0.33	110.5	4,341	3,407	31,759
	Gillnet	Jan-Apr	0.00	0.00	0.82	9.98	60.36	18.46	5.32	3.35	1.48	0.24	135.7	1,043	963	7,096
19990	Seine	Jan-Apr	0.00	6.91	26.22	20.46	17.47	23.66	3.24	1.09	0.72	0.21	111.0	5,592	928	8,409
19990	Gillnet	Jan-Apr	0.00	0.00	1.28	7.52	27.04	52.80	6.24	2.56	2.24	0.32	145.2	625	700	4,822
20001	Seine	Jan-Apr	0.00	7.02	45.66	20.20	8.38	7.57	9.44	1.32	0.21	0.21	105.3	2,352	0	0.000
20012	Seine	Jan-Apr	0.00	4.14	51.73	22.77	9.91	3.00	4.36	3.73	0.36	0.00	103.0	2,200	433	4,204
	Gillnet	Jan-Apr	0.00	0.00	0.00	10.28	28.79	15.33	20.56	22.43	2.24	0.37	152.3	535	388	2,550
20023	Seine	Jan-Apr	0.00	1.13	38.66	39.14	14.95	2.87	1.45	0.88	0.79	0.11	105.7	4,309	2,571	24,342
	Gillnet	Jan-Apr	0.00	0.00	2.61	17.43	31.86	19.84	9.82	12.83	5.01	0.80	146.7	499	945	6,443
20034	Seine	Jan-Apr	0.00	1.32	13.73	52.30	22.60	7.34	1.89	0.51	0.27	0.03	104.1	2,956	3,861	37,108
	Gillnet	Jan-Apr	0.00	0.00	0.79	26.37	24.41	25.04	14.58	3.80	2.22	0.79	137.2	631	593	4,324
20045	Seine	Jan-Apr	0.00	1.09	33.21	23.84	27.65	9.92	3.45	0.60	0.12	0.12	100.5	1,653	3,373	33,572
	Gillnet	Jan-Apr	0.00	0.00	0.80	10.80	49.80	23.80	3.80	0.20	0.20	0.00	127.5	500	896	7,030
20056	Seine	Jan-Apr	0.00	15.08	37.26	33.54	7.89	5.37	0.78	0.09	0.00	0.00	78.8	1,154	0	0.000
20067	Seine	Jan-Apr	0.00	1.16	50.33	35.05	10.96	1.83	0.66	0.00	0.00	0.00	78.3	602	0	0.000
20078	Seine	Jan-Apr	0.00	5.22	24.64	54.01	11.50	3.09	0.77	0.58	0.10	0.10	82.8	1,035	0	0.000
20089	Seine	Jan-Apr	0.00	2.43	66.41	15.64	12.71	2.27	0.55	0.00	0.00	0.00	79.6	1,810	0	0.000

NOTE: \* No biosample data available. Age composition and mean weight assigned from published reports.

+ Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods, by gear type.

- No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter.



Table 1.6. Age composition and catch by season, fishery and gear type for the Area 27 stock assessment region. Percentages represent a combination of samples taken from commercial fisheries and pre-fishery charters. Age-9+ represents the plus group of ages.

Season	Gear	Fishery	P E R C E N T A T A G E										Mean Weight	Number Aged	C A T C H	
			0+	1+	2+	3+	4+	5+	6+	7+	8+	9+			(tonnes)	(millions)
19534	Seine	Jan-Apr	0.03	2.56	62.55	28.12	5.74	0.69	0.19	0.08	0.02	0.02	92.9	6,361 +	1,920	20,667
19545	Seine	Oct-Dec	0.00	2.77	35.29	52.70	7.55	1.48	0.33	0.08	0.00	0.00	99.0	1,412	5,939	58,757
	Seine	Jan-Apr	0.00	6.80	34.77	49.12	6.94	1.42	0.28	0.07	0.00	0.00	96.7	1,412	0	0,000 -
19559	Seine	Jan-Apr	0.00	4.12	44.71	27.63	14.44	3.90	2.45	2.06	0.58	0.11	93.3	3,594 +	407	4,366
19601	Seine	Jan-Apr	0.00	38.31	37.97	19.15	4.41	0.17	0.00	0.00	0.00	0.00	85.5	590 +	1,149	13,434
19612	Seine	Jan-Apr	0.00	4.82	82.29	9.63	2.41	0.86	0.00	0.00	0.00	0.00	93.2	1,163 +	173	1,856
19623	Seine	Jan-Apr	0.00	1.99	43.18	48.71	5.16	0.75	0.21	0.00	0.00	0.00	101.3	1,862 +	31	0,304
19634	Seine	Jan-Apr	0.00	1.33	59.98	26.04	11.56	0.83	0.25	0.00	0.00	0.00	103.7	1,202 +	323	3,113
19645	Seine	Jan-Apr	0.00	2.51	31.20	46.10	14.62	4.60	0.42	0.28	0.28	0.00	125.6	718 +	769	6,113
19656	Seine	Oct-Dec	0.00	13.59	26.83	26.12	23.17	9.07	1.23	0.00	0.00	0.00	137.0	0 *	125	3,913
	Seine	Jan-Apr	0.00	13.59	26.83	26.12	23.17	9.07	1.23	0.00	0.00	0.00	137.0	0 *	826	6,032
19667	Seine	Jan-Apr	2.43	20.71	55.46	16.68	3.43	0.80	0.26	0.19	0.04	0.00	106.7	0 *	51	0,482
19701	Seine	Jan-Apr	0.00	19.86	30.14	40.41	4.79	2.05	1.37	0.68	0.68	0.00	131.8	146	0	0,000 -
19734	Seine	Jan-Apr	0.00	8.03	43.12	23.94	13.56	8.83	2.23	0.22	0.04	0.02	111.3	5,389 +	508	4,562
	Gillnet	Jan-Apr	0.00	8.03	43.12	23.94	13.56	8.83	2.23	0.22	0.04	0.02	111.3	5,389 +	18	0,165
19756	Gillnet	Jan-Apr	0.00	0.00	1.03	41.48	32.92	15.35	6.05	2.80	0.30	0.07	149.7	1,355 +	79	0,525
19778	Seine	Jan-Apr	0.00	0.81	41.60	18.95	15.70	17.59	3.84	1.17	0.23	0.11	111.8	7,925 +	75	0,670
	Gillnet	Jan-Apr	0.00	0.00	1.42	5.45	21.33	49.05	17.54	4.74	0.24	0.24	157.6	422 +	75	0,477
19789	Seine	Jan-Apr	0.00	0.82	13.66	50.49	14.19	10.61	7.80	1.59	0.50	0.11	124.1	3,765 +	422	3,401
	Gillnet	Jan-Apr	0.00	0.00	0.93	27.43	27.61	23.32	17.35	2.80	0.37	0.19	159.6	536 +	270	1,695
19790	Seine	Jan-Apr	0.00	7.17	82.08	8.96	1.43	0.00	0.00	0.36	0.00	0.00	84.2	279	0	0,000 -
	Gillnet	Jan-Apr	0.00	6.28	46.56	15.12	18.71	3.93	4.93	2.07	0.32	0.07	106.6	4,014 +	519	4,873
19801	Seine	Jan-Apr	0.00	2.06	13.73	60.33	8.74	13.59	1.53	0.00	0.00	0.00	113.6	721	0	0,000 -
	Gillnet	Jan-Apr	0.00	4.30	34.23	32.33	9.78	12.20	4.73	1.79	0.50	0.14	114.0	5,747 +	671	5,554
19812	Seine	Jan-Apr	0.00	0.60	30.57	6.73	47.59	4.07	7.53	0.75	0.15	0.00	118.6	864	238	2,011
	Gillnet	Jan-Apr	0.00	0.00	0.63	11.62	44.58	11.77	27.63	3.30	0.31	0.16	137.7	637 +	332	2,411
19823	Seine	Jan-Apr	0.00	3.96	20.79	31.68	10.89	28.71	0.00	3.96	0.00	0.00	108.4	101	0	0,000 -
	Gillnet	Jan-Apr	0.00	0.00	0.31	13.52	22.73	47.00	5.99	9.98	0.31	0.15	138.0	651 +	183	1,181
19834	Gillnet	Jan-Apr	0.00	0.00	0.00	4.17	42.13	16.67	33.33	2.55	1.16	0.00	154.2	432	171	1,107
19856	Seine	Jan-Apr	0.00	2.21	23.62	63.47	2.58	1.48	1.85	2.58	2.21	0.00	136.5	271	0	0,000 -
19867	Seine	Jan-Apr	0.00	17.02	27.66	15.96	35.46	1.06	0.00	1.06	0.35	1.42	131.2	282	0	0,000 -
19878	Seine	Jan-Apr	0.00	2.16	62.53	11.05	6.20	15.36	1.62	0.81	0.00	0.27	121.3	371	0	0,000 -
19889	Seine	Jan-Apr	0.00	0.21	12.66	57.51	8.15	8.37	11.37	1.29	0.43	0.00	151.3	466	0	0,000 -
19890	Seine	Jan-Apr	0.00	1.84	22.68	14.25	39.63	5.83	7.13	7.78	0.65	0.22	158.0	926	0	0,000 -
19901	Seine	Oct-Dec	0.01	6.71	22.27	20.52	10.65	32.59	2.99	3.50	0.73	0.03	131.8	7,580 +	0	0,001 -
	Seine	Jan-Apr	0.27	8.94	39.30	8.94	10.30	22.49	2.71	4.88	2.17	0.00	128.4	369	0	0,000 -
19912	Seine	Jan-Apr	0.00	1.30	66.59	13.39	4.27	3.20	7.11	1.42	1.90	0.83	130.0	844	335	2,580
19923	Seine	Jan-Apr	0.00	11.30	35.79	38.93	5.02	1.57	1.41	5.02	0.31	0.63	108.5	637	0	0,000 -
	Gillnet	Jan-Apr	0.00	0.00	3.28	53.28	14.09	7.92	7.53	11.58	0.97	1.35	146.6	518	367	2,502
19934	Seine	Jan-Apr	0.00	1.48	31.75	24.55	30.90	5.50	2.12	2.86	0.53	0.32	119.5	945	0	0,000 -
	Gillnet	Jan-Apr	0.00	0.00	1.28	19.40	61.19	9.81	3.41	3.84	0.43	0.64	140.4	489	345	2,455
19945	Seine	Jan-Apr	0.00	1.29	6.83	30.93	27.19	25.26	5.28	1.55	1.29	0.39	130.6	776	88	0,670
	Trawl	May	0.00	1.68	6.37	35.29	24.37	24.65	4.13	1.33	1.61	0.56	131.3	1,428 +	0	0,000
19956	Seine	Jan-Apr	0.00	10.19	24.60	7.91	20.91	17.75	14.76	3.16	0.35	0.35	120.9	569	0	0,000 -
	Trawl	May	0.00	10.19	24.60	7.91	20.91	17.75	14.76	3.16	0.35	0.35	120.9	569 +	0	0,000
19967	Seine	Jan-Apr	0.00	4.01	76.83	7.32	1.57	4.01	4.70	1.57	0.00	0.00	89.9	574	0	0,000 -
19978	Seine	Jan-Apr	0.00	1.39	38.89	48.61	4.66	0.35	2.78	2.43	0.69	0.00	90.8	288	0	0,000 -
19989	Seine	Jan-Apr	0.00	7.76	28.03	33.82	24.87	4.08	0.53	0.26	0.13	0.69	86.9	760	0	0,000 -
19990	Seine	Jan-Apr	0.00	2.30	54.36	24.20	9.65	7.50	1.23	0.15	0.46	0.15	89.9	653	0	0,000 -
20001	Seine	Jan-Apr	0.00	6.63	20.92	35.71	12.76	12.24	8.69	1.02	0.51	0.51	91.7	196	0	0,000 -
20012	Seine	Jan-Apr	0.00	7.49	62.74	15.83	10.06	0.64	2.36	0.86	0.21	0.00	96.7	467	0	0,000 -
20023	Seine	Jan-Apr	0.00	0.52	51.13	37.09	6.24	3.99	0.17	0.69	0.17	0.00	104.9	577	0	0,000 -
20034	Seine	Jan-Apr	0.00	1.30	21.50	54.15	19.69	1.04	1.55	0.78	0.00	0.00	98.1	386	0	0,000 -
20045	Seine	Jan-Apr	0.00	0.56	54.19	24.02	12.85	7.26	0.56	0.56	0.00	0.00	81.1	179	0	0,000 -
20067	Seine	Jan-Apr	0.00	1.10	46.14	30.91	15.89	3.53	2.21	0.22	0.00	0.00	75.5	453	0	0,000 -
20078	Seine	Jan-Apr	0.00	1.64	3.28	59.56	21.86	12.02	1.37	0.27	0.00	0.00	82.7	366	0	0,000 -
20089	Seine	Jan-Apr	0.00	1.26	62.66	10.21	20.00	3.22	2.52	0.00	0.14	0.00	80.9	715	0	0,000 -

NOTE: \* No biosample data available. Age composition and mean weight assigned from published reports.  
+ Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods, by gear type.  
- No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter.

Table 1.7 Age composition and catch by season, fishery and gear type for the Area 2W stock assessment region. Percentages represent a combination of samples taken from commercial fisheries and pre-fishery charters. Age-9+ represents the plus group of ages.

Season	Gear	Fishery	PERCENT AT AGE										Mean Weight	Number Aged	CATCH	
			0+	1+	2+	3+	4+	5+	6+	7+	8+	9+			(tonnes)	(millions)
19567	Seine	Jan-Apr	0.07	20.00	25.34	16.22	9.41	25.92	2.46	0.47	0.11	0.00	104.2	4,506 +	106	1 016
19634	Seine	Jan-Apr	0.00	1.02	15.92	60.00	16.53	5.31	1.22	0.00	0.00	0.00	113.9	490 +	312	2 743
19645	Seine	Jan-Apr	0.00	1.59	80.07	10.20	5.14	1.78	0.84	0.37	0.00	0.00	104.0	1 069 +	1,251	12 030
19656	Seine	Jan-Apr	1.67	18.05	32.22	16.11	10.23	7.33	5.79	4.84	2.04	1.72	128.8	0 +	172	1 338
19723	Seine	Jan-Apr	0.00	0.16	38.08	21.42	26.62	10.93	1.93	0.80	0.05	0.00	144.7	1,667 +	706	4 878
19734	Seine	Jan-Apr	0.00	0.51	31.47	38.54	17.89	8.36	2.58	0.49	0.06	0.00	126.9	1,627 +	403	3 178
	Gillnet	Jan-Apr	0.00	50.98	11.11	5.88	15.69	5.88	9.15	1.31	0.00	0.00	101.0	153	0	0 000 +
19745	Seine	Jan-Apr	0.00	0.63	26.50	34.13	27.01	9.18	2.05	0.41	0.09	0.00	130.8	6,354 +	449	3 436
19756	Seine	Jan-Apr	0.00	23.71	6.70	41.24	23.71	4.64	0.00	0.00	0.00	0.00	139.8	194	0	0 000 +
19778	Seine	Jan-Apr	0.00	0.15	23.63	18.15	9.48	28.96	13.11	5.04	1.26	0.22	150.5	1,350 +	575	3 819
19789	Seine	Jan-Apr	0.00	1.49	18.84	22.95	16.23	22.95	13.81	1.87	1.12	0.75	151.9	536	691	4 546
19790	Seine	Jan-Apr	0.00	0.37	76.03	13.11	4.49	3.37	1.87	0.00	0.75	0.00	108.8	267	0	0 000 +
19801	Seine	Jan-Apr	0.00	4.98	1.87	66.92	11.97	6.35	5.02	1.79	0.84	0.26	132.9	1,232	770	5 808
19812	Seine	Jan-Apr	0.00	0.02	53.90	2.31	34.93	3.91	2.55	2.02	0.23	0.13	139.5	1,654	1,225	9 099
19823	Seine	Jan-Apr	0.00	0.50	1.52	68.64	3.59	20.49	2.37	1.43	0.83	0.64	151.9	3,356	2,516	16 808
19834	Seine	Jan-Apr	0.00	6.45	1.61	0.60	35.28	2.42	51.01	1.81	0.60	0.20	166.2	496	0	0 000 +
19845	Seine	Jan-Apr	0.00	0.40	0.67	5.80	2.56	13.75	1.62	74.39	0.67	0.13	212.3	742	199	9 940
19856	Seine	Jan-Apr	0.00	0.82	0.27	11.48	11.75	5.46	20.77	7.38	41.53	0.55	205.2	366	0	0 000 +
19867	Seine	Jan-Apr	0.00	22.14	61.32	0.25	1.27	1.27	8.14	1.02	3.31		112.0	393	0	0 000 +
19878	Seine	Jan-Apr	0.00	1.79	74.01	19.31	0.26	0.53	0.66	0.79	1.65	0.99	114.1	1,512	0	0 000 +
19889	Seine	Jan-Apr	0.00	0.49	3.42	76.06	15.88	0.49	0.49	0.98	0.81	1.38	137.6	1,228	0	0 000 +
19890	Seine	Jan-Apr	0.00	0.19	1.71	2.28	80.41	13.18	0.46	0.18	0.70	0.90	168.1	2,353	2,272	13 608
19901	Seine	Jan-Apr	0.00	0.50	6.46	0.89	1.84	68.91	19.83	0.72	0.45	0.39	173.3	1,795	2,558	14 762
19912	Seine	Jan-Apr	0.00	1.48	6.34	13.44	1.37	2.79	60.55	12.46	0.55	1.04	183.5	1,830	1,264	6 994
19923	Seine	Jan-Apr	0.00	0.76	11.71	16.46	13.53	1.91	4.57	44.54	5.67	0.84	156.7	2,574	1,306	7 985
19934	Seine	Jan-Apr	0.00	5.32	12.23	43.62	14.89	9.57	2.13	5.85	5.32	1.06	145.6	188	0	0 000 +
19978	Seine	Jan-Apr	0.00	19.50	31.34	24.01	18.53	3.34	0.85	2.18	0.27	0.00	121.0	1,108	359	2 967
19989	Seine	Jan-Apr	0.00	15.60	32.38	28.09	14.30	7.28	1.56	0.52	0.26	0.00	116.8	769	0	0 000 +
19990	Seine	Jan-Apr	0.00	14.77	63.64	18.18	0.00	2.27	0.00	1.14	0.00	0.00	85.0	98	0	0 000 +
20001	Seine	Jan-Apr	0.00	4.37	8.48	40.62	24.42	12.08	6.94	2.06	0.51	0.51	153.2	389	0	0 000 +
20012	Seine	Jan-Apr	0.00	28.69	23.83	4.77	21.64	9.72	6.86	2.67	1.53	0.29	130.5	1,049	0	0 000 +
20023	Seine	Jan-Apr	0.00	1.03	73.49	15.31	3.39	3.69	1.15	1.33	0.36	0.24	111.3	1,652	0	0 000 +
20034	Seine	Jan-Apr	0.00	7.24	9.74	71.71	7.50	1.71	1.58	0.26	0.00	0.26	124.5	760	0	0 000 +
20045	Seine	Jan-Apr	0.00	0.36	26.68	8.63	58.76	4.04	0.54	0.81	0.00	0.18	122.7	1 113	0	0 000 +
20056	Seine	Jan-Apr	0.00	10.75	13.98	17.63	6.88	44.95	3.44	1.72	0.65	0.00	132.4	465	0	0 000 +
20067	Seine	Jan-Apr	0.00	0.31	57.89	11.30	6.50	3.25	18.58	1.55	0.46	0.15	102.9	646	0	0 000 +
20078	Seine	Jan-Apr	0.00	34.08	1.68	41.90	8.38	2.79	2.23	8.38	0.00	0.56	99.6	179	0	0 000 +
20089	Seine	Jan-Apr	0.00	2.58	72.48	2.46	12.16	2.21	2.46	2.21	2.95	0.49	102.7	814	0	0 000 +

NOTE: + No biosample data available. Age composition and mean weight assigned from published reports.

+ Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods, by gear type.

- No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter.

Table 2.1. Estimated numbers of age, spawning stock biomass (SB), spawn index (SI), residuals (RES) and other model estimated parameters for the Queen Charlotte Island stock assessment region. Age notation refers to age at beginning of fishery.

Season	Estimated numbers at age (x 10 000)										SB	SI	RES
	2	3	4	5	6	7	8	9	10				
1950/51	1.907	1.445	1.636	406	246	82	22	10	10	19.384	4.213	-0.2	
1951/52	4.531	1.198	847	930	228	138	46	12	11	17.178	2.578	-0.57	
1952/53	16.769	2.827	587	371	394	96	58	19	10	36.190	7.555	-0.24	
1953/54	3.063	11.219	1.891	393	248	264	64	38	19	50.949	12.408	-0.08	
1954/55	3.161	2.051	7.372	1.233	255	161	171	42	38	86.552	6.437	-1.01	
1955/56	1.642	2.093	1.346	4.819	805	187	105	112	52	17.296	6.042	0.28	
1956/57	2.565	916	522	215	687	110	23	14	22	2.923	1.592	0.72	
1957/58	11.816	1.298	152	42	15	45	7	1	2	6.851	815	-0.8	
1958/59	2.835	5.976	339	28	1	2	7	1	1	25.627	8.881	0.26	
1959/60	8.648	1.515	2.797	150	12	3	1	3	1	23.647	6.599	0.05	
1960/61	7.105	4.645	813	1.502	80	7	2	1	2	35.532	8.881	-0.05	
1961/62	9.407	3.787	2.454	428	790	42	3	1	1	45.542	5.730	-0.74	
1962/63	2.429	4.989	1.862	1.167	202	370	20	2	1	39.454	7.297	-0.36	
1963/64	6.618	1.284	2.262	788	483	83	152	8	1	16.893	4.104	-0.09	
1964/65	1.089	3.264	384	528	172	103	18	32	2	3.902	1.378	0.29	
1965/66	1.300	468	441	24	28	9	5	1	2	4.595	2.824	0.84	
1966/67	1.071	598	172	146	8	9	3	2	1	5.397	710	-0.7	
1967/68	1.687	488	268	76	65	3	4	1	1	6.057	833	-0.66	
1968/69	2.875	782	225	123	35	30	2	2	1	8.602	2.075	-0.09	
1969/70	5.005	1.395	380	109	60	17	14	1	1	14.694	5.552	0.36	
1970/71	5.273	2.552	713	194	58	30	9	7	1	24.140	13.291	0.73	
1971/72	10.416	2.798	1.351	377	102	29	16	5	4	36.540	9.542	-0.01	
1972/73	8.194	5.733	1.467	659	169	43	12	6	4	53.779	7.960	-0.58	
1973/74	6.120	4.772	3.140	720	282	65	16	4	4	63.896	14.510	-0.15	
1974/75	2.498	3.777	2.837	1.744	366	133	30	7	4	59.607	6.696	-0.49	
1975/76	2.223	1.591	2.321	1.637	927	182	64	14	5	47.300	16.374	0.27	
1976/77	2.877	1.421	963	1.272	771	375	69	24	7	33.855	16.408	0.6	
1977/78	1.440	1.604	837	500	561	289	129	23	10	22.631	18.371	1.12	
1978/79	31.654	875	1.013	393	175	154	67	28	7	41.679	13.649	0.21	
1979/80	3.289	16.880	484	470	124	43	32	12	8	96.194	31.904	0.22	
1980/81	1.585	1.993	11.285	281	235	50	16	11	6	90.362	20.294	-0.17	
1981/82	1.631	966	1.195	6.531	152	104	19	6	6	65.535	23.593	0.31	
1982/83	13.467	989	580	702	3.735	83	52	9	5	59.162	21.391	0.31	
1983/84	6.177	7.935	573	326	377	1.932	42	26	7	64.920	23.439	0.31	
1984/85	1.787	3.450	4.350	304	164	184	917	19	15	55.644	18.625	0.23	
1985/86	2.449	931	1.759	2.112	137	89	75	358	13	38.963	6.847	-0.41	
1986/87	15.089	1.212	453	825	944	59	29	31	153	35.812	12.289	0.26	
1987/88	5.419	7.463	590	214	376	419	26	13	80	48.150	15.245	-1.15	
1988/89	1.890	2.755	3.793	299	109	191	212	13	47	44.389	25.201	-0.57	
1989/90	889	1.007	1.453	1.984	152	54	94	105	30	27.376	27.058	-0.01	
1990/91	5.139	482	522	696	826	56	18	29	41	17.367	17.998	0.04	
1991/92	529	2.730	244	242	286	303	19	6	20	18.509	12.376	-0.4	
1992/93	623	269	1.337	112	101	112	115	7	10	10.163	8.152	-0.22	
1993/94	1.852	304	123	549	40	33	34	34	5	7.359	14.293	0.06	
1994/95	3.399	869	141	56	245	17	14	15	17	9.239	4.701	-0.68	
1995/96	3.919	1.537	393	64	25	111	8	6	14	11.679	7.377	-0.46	
1996/97	8.617	1.802	706	181	29	12	51	4	10	17.998	11.215	-0.47	
1997/98	863	4.055	948	332	85	14	6	24	6	18.637	21.648	0.15	
1998/99	2.201	307	1.819	359	131	32	5	2	11	10.818	10.610	0	
1999/2000	2.670	952	124	642	107	30	6	1	1	6.704	6.698	0	
2000/01	2.975	1.033	341	39	169	25	6	1	0	6.365	15.195	0.87	
2001/02	7.738	1.035	358	118	13	59	9	2	1	6.576	3.257	-0.75	
2002/03	1.346	2.375	300	94	27	3	12	2	1	7.642	6.801	0.14	
2003/04	4.945	414	730	92	29	8	1	4	1	5.600	5.666	0.01	
2004/05	1.136	1.545	129	228	29	9	3	0	1	5.448	3.614	-0.41	
2005/06	5.009	369	502	42	74	9	3	1	1	5.049	4.097	-0.21	
2006/07	7.75	1.768	130	177	15	26	3	1	0	6.340	9.436	0.4	
2007/08	5.881	288	606	48	66	6	10	1	1	6.138	4.213	-0.38	
2008/09	823	2.235	109	249	18	25	2	4	1	7.130	5.935	0.23	

Estimated gillnet selectivity at age (averaged over all years):

2	3	4	5	6	7	8	9	10
0.00	0.01	0.06	0.25	0.52	0.72	0.87	1.00	1.00

Spawn index proportionality coefficient (pre-1988):

0.26

Table 2.2. Estimated numbers at age, spawning stock biomass (SSB), spawn index (SI), residuals (RES) and other model estimated parameters for the Prince Rupert District stock assessment region. Age notation refers to age at beginning of fishery.

Season	Estimated numbers at age (x 10,000)										SSB	SI	RES
	2	3	4	5	6	7	8	9	10				
1950/51	4,678	5,918	7,331	1,078	396	180	54	30	42	50,396	27,149	0.09	
1951/52	4,767	2,835	2,774	2,724	306	79	24	9	3	25,702	24,047	0.64	
1952/53	7,150	2,900	1,129	745	468	29	4	1	0	37,078	28,468	0.40	
1953/54	1,940	4,767	1,907	731	473	289	16	2	0	28,459	13,535	-0.03	
1954/55	6,999	1,252	2,364	739	314	96	38	1	0	22,987	14,482	0.25	
1955/56	2,978	4,309	850	999	345	52	19	4	0	28,703	14,533	0.03	
1956/57	5,962	1,956	2,506	339	459	95	17	4	1	15,947	27,518	-1.29	
1957/58	15,014	3,544	798	710	63	50	5	0	0	33,170	9,882	0.5	
1958/59	4,512	9,238	2,962	442	371	31	22	2	0	57,894	40,981	0.36	
1959/60	36,589	2,671	5,094	1,969	212	162	12	8	1	58,147	16,545	-0.55	
1960/61	19,194	20,850	1,362	2,352	439	75	48	3	2	90,838	12,059	1.31	
1961/62	10,621	10,591	9,728	547	792	118	15	7	0	101,562	26,329	-0.64	
1962/63	34,536	5,949	5,325	4,520	231	297	38	4	2	78,325	16,981	-0.79	
1963/64	5,756	17,955	2,691	2,129	1,562	66	66	7	1	77,943	26,919	-0.35	
1964/65	2,035	2,748	7,703	1,051	743	471	17	14	1	38,854	8,055	-1.17	
1965/66	2,840	829	918	2,155	239	129	59	2	1	11,432	7,105	0.23	
1966/67	4,449	1,054	247	224	418	34	13	4	0	5,327	3,396	0.26	
1967/68	2,598	1,616	290	53	36	45	2	1	0	8,856	5,197	0.43	
1968/69	6,489	1,016	574	95	16	9	10	0	0	10,081	965	-1.64	
1969/70	3,985	2,853	447	252	42	7	4	4	0	16,738	8,814	0.07	
1970/71	1,370	2,005	1,390	212	116	18	3	2	2	16,423	8,480	0.05	
1971/72	3,680	753	1,027	670	95	47	7	1	1	19,439	8,774	-0.09	
1972/73	2,846	2,195	412	495	306	43	21	3	1	22,965	10,959	-0.03	
1973/74	1,631	1,612	1,354	242	286	176	24	12	2	27,543	9,244	-0.38	
1974/75	855	1,089	1,169	806	127	146	89	12	7	24,767	10,940	-0.11	
1975/76	1,166	593	737	763	519	81	93	57	12	25,996	15,587	0.2	
1976/77	509	829	402	462	461	309	46	55	40	17,754	11,589	0.28	
1977/78	460	368	539	219	219	208	136	21	40	10,995	6,164	0.13	
1978/79	3,886	336	242	285	89	74	63	38	15	11,575	9,195	0.48	
1979/80	1,319	2,860	227	135	135	37	29	23	18	20,660	11,937	0.16	
1980/81	1,563	988	2,022	142	69	62	16	12	17	22,647	14,087	0.23	
1981/82	2,380	1,172	708	1,369	88	39	33	8	14	26,246	17,186	0.29	
1982/83	6,334	1,779	855	504	952	60	25	21	13	38,228	25,247	0.28	
1983/84	2,050	4,707	1,322	635	375	707	44	19	25	48,570	27,041	0.17	
1984/85	2,092	1,495	3,371	920	423	235	409	22	20	43,707	41,028	0.65	
1985/86	6,210	1,490	1,035	2,212	572	240	117	168	15	47,541	26,638	0.13	
1986/87	4,623	4,281	994	636	1,238	304	122	58	89	49,935	39,905	0.49	
1987/88	3,003	3,082	2,798	619	361	644	148	58	67	42,561	35,444	-0.18	
1988/89	1,639	1,938	1,926	1,645	333	163	245	56	42	33,565	16,379	-0.72	
1989/90	6,479	1,038	1,182	1,091	830	128	53	65	26	32,625	22,679	-0.36	
1990/91	5,750	4,117	640	696	596	414	59	23	39	39,554	25,811	-0.43	
1991/92	2,237	3,707	2,609	387	389	320	203	27	26	41,347	40,145	-0.03	
1992/93	997	1,464	2,389	1,627	208	176	130	73	16	33,770	25,071	-0.3	
1993/94	2,007	657	940	1,440	896	88	58	38	21	24,489	16,589	-0.39	
1994/95	5,499	1,335	423	568	815	465	34	21	18	26,930	18,516	0.37	
1995/96	2,575	3,718	892	277	357	494	265	17	19	34,322	24,854	-0.32	
1996/97	3,451	1,762	2,541	601	177	194	251	120	14	31,080	25,037	-0.22	
1997/98	1,199	2,360	1,202	1,706	356	75	50	46	16	28,610	19,420	-0.39	
1998/99	3,054	804	1,577	789	1,045	190	18	5	1	29,119	29,745	0.02	
1999/2000	5,104	1,981	518	991	480	585	102	7	2	25,212	19,694	0.25	
2000/01	3,264	3,214	1,220	305	523	235	240	29	2	28,354	36,884	0.26	
2001/02	10,607	2,014	1,952	718	172	252	110	97	12	29,935	22,449	-0.29	
2002/03	1,503	6,407	1,178	1,079	359	73	83	32	20	38,632	34,007	-0.13	
2003/04	4,060	890	3,721	661	541	140	21	20	11	29,396	30,493	0.04	
2004/05	2,728	2,334	499	1,981	328	223	36	3	4	21,961	27,956	-0.24	
2005/06	7,678	1,510	1,254	256	909	139	69	5	1	20,415	10,251	-0.69	
2006/07	2,390	4,116	793	633	125	374	44	15	1	20,935	15,962	-0.3	
2007/08	2,837	1,263	2,175	418	322	54	152	14	3	18,120	13,553	-0.29	
2008/09	1,596	1,480	652	1,093	202	140	20	36	3	14,758	12,684	-0.15	

Estimated gillnet selectivity at age (averaged over all years)

2	3	4	5	6	7	8	9	10
0.00	0.01	0.08	0.27	0.47	0.64	0.84	1.00	1.00

Spawn index proportionality coefficient (pre-1988)

0.49

Table 2.1. Estimated numbers at age, spawning stock biomass (SB), spawn index (SI), residuals (RES), and other model estimated parameters for the Central Coast stock assessment region. Age notation refers to age at beginning of fishery.

Season	Estimated numbers at age (x 10,000)										SB	SI	RES
	2	3	4	5	6	7	8	9	10				
1950/51	3,694	4,691	4,808	814	309	88	31	16	17	39,968	15,390	0.33	
1951/52	4,583	2,240	2,153	1,844	191	43	7	1	1	20,554	10,295	0.58	
1952/53	19,282	2,728	979	820	293	18	2	0	0	37,319	18,237	0.57	
1953/54	2,589	12,085	1,898	579	378	176	10	1	0	42,912	13,967	0.16	
1954/55	2,886	1,555	5,917	671	173	77	23	1	0	41,751	13,564	0.18	
1955/56	6,296	1,750	870	3,043	309	69	26	6	0	14,542	8,626	0.5	
1956/57	9,142	3,511	836	199	386	17	1	0	0	12,448	4,807	0.29	
1957/58	11,494	4,906	1,104	111	17	12	0	0	0	24,825	3,549	-0.66	
1958/59	3,887	6,481	2,319	434	34	4	2	0	0	24,227	3,904	-0.54	
1959/60	10,959	2,124	2,466	599	58	3	0	0	0	26,800	12,615	0.51	
1960/61	16,793	6,255	1,148	1,259	284	29	1	0	0	29,317	4,295	-0.84	
1961/62	9,605	8,896	2,431	320	230	29	1	0	0	49,452	11,948	-0.13	
1962/63	8,434	5,180	4,237	1,022	114	96	6	0	0	28,835	6,485	-0.21	
1963/64	5,742	4,252	1,760	949	134	7	2	0	0	17,222	8,464	0.31	
1964/65	4,755	2,771	1,339	349	105	7	0	0	0	17,112	2,097	0.82	
1965/66	12,383	2,196	989	364	87	12	0	0	0	4,861	1,863	0.33	
1966/67	6,759	4,663	271	29	2	0	0	0	0	9,685	5,434	0.71	
1967/68	4,085	2,459	913	26	1	0	0	0	0	14,038	5,790	0.4	
1968/69	11,823	1,539	591	318	9	0	0	0	0	17,819	1,837	-0.99	
1969/70	8,493	4,656	606	351	125	3	0	0	0	30,285	8,230	-0.02	
1970/71	6,233	3,810	2,083	270	156	55	2	0	0	35,486	4,156	0.86	
1971/72	7,628	3,158	1,665	984	122	96	22	1	0	36,097	3,572	-1.03	
1972/73	5,047	4,322	1,606	810	388	46	25	8	0	47,046	12,434	-0.05	
1973/74	5,913	3,116	2,498	825	381	177	21	11	4	45,722	8,852	-0.36	
1974/75	2,807	3,834	1,953	1,377	378	147	85	7	5	48,530	8,037	0.51	
1975/76	1,937	1,866	2,481	1,148	674	164	81	27	1	37,135	13,849	0.3	
1976/77	2,658	1,269	1,179	1,402	504	239	52	19	10	29,938	14,813	0.57	
1977/78	1,854	1,740	807	650	618	174	77	16	9	17,631	7,747	0.46	
1978/79	15,284	1,186	1,034	365	176	79	17	7	2	43,139	5,779	0.72	
1979/80	3,686	9,810	761	663	234	113	51	11	6	63,638	13,012	-0.3	
1980/81	3,320	2,393	5,365	492	419	142	67	30	10	62,039	15,919	-0.07	
1981/82	1,482	2,186	1,571	4,110	302	226	67	27	16	59,761	16,333	-0.01	
1982/83	1,366	983	1,429	991	2,404	169	119	33	21	46,156	18,482	0.37	
1983/84	4,035	900	638	896	587	1,349	92	64	28	32,679	14,185	0.45	
1984/85	2,032	2,607	561	372	485	293	643	41	35	34,362	8,850	-0.07	
1985/86	3,135	1,282	1,581	317	196	246	144	312	38	32,089	20,342	0.63	
1986/87	14,316	1,942	772	903	172	103	128	75	181	41,091	12,827	0.12	
1987/88	1,275	8,781	1,153	432	477	68	53	65	130	59,253	26,916	-0.79	
1988/89	934	793	5,293	658	233	244	45	27	89	43,309	21,561	-0.7	
1989/90	2,401	601	465	2,966	316	98	90	16	45	31,884	28,980	-0.1	
1990/91	9,805	1,602	382	283	1,564	146	41	37	25	33,302	19,163	0.55	
1991/92	1,516	6,899	1,008	212	140	716	63	17	26	49,110	43,274	-0.13	
1992/93	1,918	1,056	4,341	585	113	70	340	29	20	40,482	32,382	-0.22	
1993/94	751	1,343	688	2,504	303	53	31	136	16	28,474	29,432	0.03	
1994/95	2,109	522	849	371	1,166	130	20	11	55	17,720	22,348	0.23	
1995/96	6,985	1,442	316	424	159	462	48	7	23	22,732	21,646	-0.05	
1996/97	7,282	4,721	901	176	216	78	221	22	14	35,886	28,255	-0.24	
1997/98	1,608	4,887	3,015	534	99	116	40	113	15	38,917	31,503	-0.21	
1998/99	2,797	1,072	2,960	1,611	262	45	45	15	46	32,388	31,813	-0.02	
1999/2000	1,323	1,856	669	1,683	823	124	17	12	14	27,123	32,652	0.19	
2000/01	3,255	860	1,119	361	831	379	53	7	10	19,825	25,109	0.24	
2001/02	7,208	2,043	494	562	168	363	159	22	7	21,744	23,147	0.06	
2002/03	2,109	4,333	1,157	256	273	78	163	69	12	28,294	25,679	-0.1	
2003/04	6,297	1,201	2,372	598	127	130	36	74	36	22,625	28,407	0.26	
2004/05	1,875	3,357	606	1,106	266	56	57	16	48	17,942	24,158	0.3	
2005/06	3,249	915	1,504	240	408	96	20	20	23	9,900	12,051	0.2	
2006/07	1,181	1,439	362	507	74	122	29	6	13	7,831	9,857	0.23	
2007/08	7,819	483	576	141	194	28	46	11	7	7,688	3,971	-0.66	
2008/09	1,799	3,045	188	224	55	75	11	18	7	9,916	10,183	0.03	

Estimated gillnet selectivity at age (averaged over all years)

2	3	4	5	6	7	8	9	10
0.00	0.01	0.08	0.32	0.57	0.77	0.90	1.00	1.00

Spawn index proportionality coefficient (pre-1988)

0.28

Table 2.4. Estimated numbers at age, spawning stock biomass (SB), spawn index (SI), residuals (RES) and other model estimated parameters for the Strait of Georgia stock assessment region. Age notation refers to age at beginning of fishery

Season	Estimated numbers at age (x 10,000)										SB	SI	RES
	2	3	4	5	6	7	8	9	10				
1950/51	13,316	7,710	3,113	711	177	64	23	8	5	48,215	96,143	0.37	
1951/52	15,391	7,993	3,025	1,056	239	80	21	8	4	52,182	72,376	0.34	
1952/53	20,002	9,422	3,261	1,075	372	84	21	8	4	81,028	111,307	0.33	
1953/54	14,584	13,032	5,770	1,960	645	223	50	13	7	91,025	82,141	-0.09	
1954/55	8,645	9,235	5,860	2,314	780	257	89	20	8	76,242	69,854	-0.07	
1955/56	9,544	5,510	3,976	2,210	865	292	96	33	10	39,290	25,667	-0.41	
1956/57	7,269	5,935	1,791	1,013	555	217	73	24	11	22,057	24,126	0.1	
1957/58	15,247	4,441	1,578	338	188	103	40	14	6	34,221	16,149	-0.74	
1958/59	13,946	9,896	2,071	660	141	78	43	17	8	48,530	41,864	0.04	
1959/60	7,894	8,786	3,864	686	206	42	23	13	7	40,256	55,082	0.33	
1960/61	22,037	4,753	2,876	1,015	177	53	11	6	5	36,802	42,864	0.17	
1961/62	18,091	12,870	1,572	773	270	47	14	3	3	48,100	31,078	0.38	
1962/63	18,790	10,178	4,045	399	194	68	12	4	1	39,684	35,135	0.11	
1963/64	10,871	10,108	2,896	907	88	43	15	3	1	33,134	33,117	0.01	
1964/65	6,262	5,489	2,459	531	184	16	8	3	1	21,995	37,116	0.54	
1965/66	9,074	2,937	1,332	468	100	31	3	1	1	11,955	7,153	-0.5	
1966/67	5,268	3,795	559	185	64	14	4	0	0	6,018	9,819	0.48	
1967/68	5,270	1,978	507	47	15	5	1	0	0	12,063	9,128	-0.27	
1968/69	12,079	2,069	721	181	17	5	2	0	0	19,058	14,644	-0.25	
1969/70	10,226	4,801	818	285	11	7	2	1	0	31,018	33,970	0.1	
1970/71	6,950	4,262	1,893	339	118	29	3	1	0	36,360	38,180	0.06	
1971/72	5,906	3,078	1,846	855	145	50	13	1	1	27,890	25,165	-0.08	
1972/73	8,425	2,787	1,232	660	296	50	17	4	1	29,876	16,191	-0.6	
1973/74	10,824	4,385	1,303	513	247	109	18	6	2	45,615	40,354	-0.11	
1974/75	6,282	6,215	2,480	643	237	112	49	8	4	52,953	70,211	0.3	
1975/76	12,223	3,802	3,711	1,360	258	82	37	16	4	61,905	80,642	-0.01	
1976/77	9,643	7,565	2,245	1,929	808	106	33	15	8	73,109	78,562	0.09	
1977/78	4,879	6,067	4,387	1,154	828	231	38	12	8	84,489	102,115	0.47	
1978/79	8,384	3,063	3,348	2,164	461	277	72	12	6	58,671	64,266	0.1	
1979/80	7,433	5,232	1,707	1,675	938	184	108	27	7	62,507	85,991	0.33	
1980/81	7,720	4,628	3,182	1,012	923	489	95	65	17	62,700	55,121	-0.12	
1981/82	6,539	4,628	2,610	1,701	478	399	206	39	30	57,707	100,987	0.57	
1982/83	6,279	3,728	2,449	1,264	754	184	150	76	26	38,964	64,578	0.52	
1983/84	9,476	3,341	1,762	928	370	197	42	32	21	33,505	36,227	-0.23	
1984/85	16,984	4,806	1,562	892	269	85	45	9	11	43,169	35,247	-0.52	
1985/86	9,365	8,480	2,256	845	230	71	22	11	5	61,762	41,575	-0.38	
1986/87	22,618	4,736	4,264	1,132	323	115	36	11	8	62,954	41,737	0.4	
1987/88	6,622	11,650	2,324	1,896	403	88	24	7	4	78,191	24,976	-1.14	
1988/89	16,826	3,478	5,961	1,062	796	142	28	8	3	70,796	86,052	-0.07	
1989/90	8,549	9,162	1,847	2,971	452	276	48	9	3	76,760	87,152	-0.13	
1990/91	21,875	4,728	5,031	968	1,299	164	94	16	4	80,127	45,830	-0.56	
1991/92	16,007	12,085	2,552	2,500	399	447	51	28	6	96,645	82,898	-0.16	
1992/93	20,897	8,823	6,410	1,239	1,005	136	144	16	10	102,245	90,189	-0.13	
1993/94	9,805	11,423	4,824	3,074	510	360	45	46	8	87,875	87,144	-0.27	
1994/95	20,329	5,234	5,830	2,115	1,122	137	86	9	10	83,114	64,899	-0.25	
1995/96	30,652	10,530	2,604	2,676	821	388	43	27	6	91,984	71,326	-0.25	
1996/97	30,752	15,507	5,013	1,151	1,028	267	119	13	10	105,073	58,232	-0.59	
1997/98	14,224	15,381	7,257	2,170	428	301	69	29	5	99,228	74,616	-0.29	
1998/99	22,720	7,189	7,439	3,260	828	126	55	9	3	91,512	85,295	-0.07	
1999/2000	26,077	11,684	3,534	3,422	1,325	277	36	13	3	92,856	72,639	-0.25	
2000/01	32,556	13,652	5,812	1,653	1,417	401	69	7	3	122,706	100,248	-0.2	
2001/02	32,082	17,278	6,867	2,769	674	482	113	18	3	129,121	117,864	-0.09	
2002/03	18,869	16,981	8,621	3,155	1,161	199	118	22	3	123,677	141,651	0.14	
2003/04	16,385	9,791	8,241	3,860	1,261	408	41	15	5	96,934	113,689	0.16	
2004/05	13,128	8,305	4,704	3,736	1,628	461	139	10	5	72,800	95,851	0.28	
2005/06	22,668	6,502	3,831	2,011	1,370	462	99	25	3	54,792	46,752	-0.16	
2006/07	8,767	10,986	2,812	1,478	639	330	69	9	1	58,308	35,446	-0.5	
2007/08	26,005	4,245	5,027	1,227	552	143	48	6	0	41,785	32,103	-0.26	
2008/09	3,504	12,641	1,948	1,996	408	117	16	3	0	47,898	49,909	0.04	

Estimated gillnet selectivity at age (averaged over all years)

2	3	4	5	6	7	8	9	10
0.00	0.02	0.16	0.43	0.68	0.82	0.92	0.97	0.97

Spawn index proportionality coefficient (pre-1988)

0.99

Table 2.5. Estimated numbers at age, spawning stock biomass (SB), spawn index (SI), residuals (RES), and other model estimated parameters for the west coast of Vancouver Island stock assessment region. Age notation refers to age at beginning of fishery.

Season	Estimated numbers at age (x 1000)										SB	SI	RES
	2	3	4	5	6	7	8	9	10				
1950/51	3.940	2.441	2.852	395	109	38	15	6	4	23.524	19.587	0.15	
1951/52	4.527	2.445	1.032	908	133	37	13	5	3	12.063	13.310	0.43	
1952/53	7.827	2.611	660	174	148	22	8	2	1	22.474	39.571	0.9	
1953/54	5.405	4.527	1.509	381	101	86	13	3	2	13.080	20.648	0.78	
1954/55	10.755	2.800	1.035	207	50	13	11	2	1	22.835	15.112	-0.07	
1955/56	14.400	5.571	1.226	415	82	20	5	4	1	31.352	27.183	0.19	
1956/57	13.866	7.244	2.076	388	130	26	8	2	2	47.752	44.114	0.25	
1957/58	16.391	7.053	3.588	1.006	188	83	12	3	2	57.648	18.986	-0.78	
1958/59	11.055	8.383	3.587	1.810	510	95	32	6	2	27.068	12.979	-0.4	
1959/60	5.896	5.455	1.951	524	251	88	12	4	1	10.477	6.015	-0.22	
1960/61	16.773	2.825	854	138	35	17	5	1	0	14.580	10.556	0.01	
1961/62	8.787	8.138	550	92	14	4	2	0	0	27.603	34.470	0.55	
1962/63	8.836	3.378	2.722	147	24	4	1	0	0	24.531	11.245	-0.45	
1963/64	3.398	4.442	1.206	805	43	7	1	0	0	21.363	22.761	0.4	
1964/65	2.311	1.727	1.511	328	215	11	2	0	0	14.561	11.891	0.13	
1965/66	2.681	1.178	584	407	87	57	3	0	0	9.096	5.722	-0.56	
1966/67	2.483	1.372	385	149	102	22	14	1	0	5.017	4.813	0.28	
1967/68	1.819	1.245	284	45	17	11	2	2	0	11.051	11.029	0.33	
1968/69	5.398	973	686	152	24	9	6	1	1	16.448	10.485	-0.12	
1969/70	6.520	2.939	530	383	83	13	5	3	1	33.181	26.912	0.12	
1970/71	6.189	5.381	1.661	298	205	47	7	3	3	58.649	36.206	-0.17	
1971/72	7.884	3.660	3.187	984	177	121	28	4	3	63.605	41.857	-0.09	
1972/73	10.020	4.897	2.138	1.758	535	96	66	15	4	68.876	19.481	-0.93	
1973/74	14.842	8.518	2.781	1.053	819	246	44	30	9	82.888	25.540	-0.84	
1974/75	5.735	10.153	4.086	1.548	528	388	115	21	18	109.962	49.149	-0.47	
1975/76	4.185	4.026	8.541	2.284	734	242	177	52	18	85.682	64.222	0.04	
1976/77	7.742	2.943	2.538	3.431	874	245	79	57	23	88.123	58.679	0.18	
1977/78	2.687	5.381	1.835	1.295	1.472	322	87	28	28	53.926	45.607	0.16	
1978/79	8.290	1.833	3.442	1.051	525	417	76	19	12	46.714	86.397	0.68	
1979/80	6.023	5.448	1.088	1.779	362	154	116	20	8	57.576	62.308	0.41	
1980/81	3.594	3.793	3.570	855	1.007	202	77	57	14	54.210	52.063	0.29	
1981/82	2.459	2.126	2.136	1.790	313	450	86	32	30	39.889	33.047	0.14	
1982/83	4.548	1.370	1.148	1.046	858	133	182	32	23	27.648	16.771	-0.17	
1983/84	11.556	2.404	852	495	418	308	46	63	18	31.761	23.872	0.05	
1984/85	10.744	5.987	1.108	264	184	156	114	17	30	53.545	30.010	-0.25	
1985/86	3.586	5.650	3.141	580	138	96	81	60	25	62.701	39.514	-0.13	
1986/87	16.785	1.934	3.041	1.688	311	74	52	44	45	55.490	16.858	-0.66	
1987/88	3.962	9.299	937	1.252	644	117	28	19	33	71.714	46.242	-0.44	
1988/89	3.386	1.716	5.017	465	580	300	54	13	24	52.091	47.718	-0.09	
1989/90	2.205	2.002	934	2.416	205	248	123	22	15	40.295	46.454	0.14	
1990/91	7.136	1.322	1.097	461	1.123	93	111	56	17	31.607	30.456	-0.04	
1991/92	4.336	4.262	713	521	202	462	37	44	29	42.124	42.687	0.01	
1992/93	3.420	2.583	2.423	385	272	104	237	19	38	38.834	34.728	0.11	
1993/94	1.619	2.008	1.402	1.228	192	135	52	118	28	30.077	25.625	-0.16	
1994/95	2.714	946	1.062	879	569	87	80	23	94	26.116	28.057	0.07	
1995/96	12.050	1.544	518	562	358	298	45	32	46	32.136	31.986	0.06	
1996/97	4.239	6.701	844	279	301	191	160	24	41	40.052	46.490	0.15	
1997/98	2.283	2.266	3.223	369	119	128	91	68	28	26.112	41.558	0.46	
1998/99	2.736	1.174	1.053	1.327	142	37	34	20	22	16.999	20.390	0.18	
1999/2000	4.386	1.361	531	432	495	50	11	9	11	16.519	13.267	0.22	
2000/01	6.006	2.146	644	241	195	199	20	4	8	21.080	13.955	-0.41	
2001/02	5.991	2.935	1.049	315	118	91	97	10	6	24.170	22.086	-0.09	
2002/03	2.703	2.900	1.403	493	143	51	38	40	6	21.363	29.750	0.33	
2003/04	3.137	1.250	1.245	559	180	44	14	9	11	11.385	15.844	0.33	
2004/05	2.162	1.319	444	369	154	42	9	2	3	4.669	9.075	0.66	
2005/06	3.127	801	358	85	38	9	1	0	0	4.773	2.705	0.57	
2006/07	1.072	1.079	276	124	29	13	3	0	0	4.389	2.089	-0.74	
2007/08	2.926	379	382	96	44	10	5	1	0	4.373	2.148	0.54	
2008/09	1.029	1.135	147	148	38	17	4	2	0	5.055	9.876	0.67	

Estimated gillnet selectivity at age (averaged over all years)

	2	3	4	5	6	7	8	9	10
	0.00	0.02	0.17	0.48	0.73	0.87	0.94	1.00	1.00

Spawn index proportionality coefficient (pre-1988)

0.72

## B Model description and documentation

The herring catch-age model consists of five major components: (1) data, (2) model initialization, (3) model dynamics, (4) the likelihood function and (5) forecasts. We have broken the description of the assessment model into these five components and use a series of tables to document model equations. Symbols and their definitions are defined in Table 3 of Appendix B. The model assumes each of the major and minor stock areas are independent from each other, although the majority of parameter start-values and bounds are common across stocks (described throughout).

Table 3. Notation for the herring catch-age model (HCAMv2).

Symbol	Description
<b>Indices and Index Ranges</b>	
$a$	age class index, where $a = 1$ corresponds to actual age $k$
$A$	plus age class ( $A = 8$ , which corresponds to ages 9 and up )
$k$	youngest age in the model ( $k = 2$ )
$k'$	age of maturity/ recruitment to the fishery ( $k' = 3$ )
$K$	oldest age in the model ( $K = 10$ )
$n$	number of age classes ( $n = 9$ )
$p$	fishing period, where $p = 1$ corresponds to winter, $p = 2$ to seine, and $p = 3$ to gillnet
$p'$	total number of fishing periods ( $p' = 3$ )
$t$	year index
$t'$	first year of catch and survey data ( 1951, $t' = 1$ )
$T'$	final year of surface survey ( 1987, $T' = 37$ )
$T' + 1$	first year of dive survey ( 1988, $T' + 1 = 38$ )
$T$	final year ( 2009, $T = 59$ )
<b>Data</b>	
$C_{t,p}$	observed catch biomass (metric tonnes) in period $p$ of year $t$
$I_t$	observed spawn survey index in year $t$
$N_{t,p}^S$	number of age samples processed in year $t$
$P_{t,p,a}$	observed proportion of fish at age $a$ in period $p$ of year $t$ (test fishery + commercial samples combined)
$w_{t,a}$	observed mean weight-at-age $a$ in year $t$ (test fishery + commercial samples combined)
$w_{t,a}^*$	geometric mean weight-at-age $a$ in year $t$ (test fishery + commercial samples combined)



### Parameters (fixed)

$q_z$	spawn index proportionality coefficient, $q_z = 1$ for $t > T'$
$\lambda_a$	proportion of age $a$ fish available to the fishery, constant across all years ( $\lambda_2=0.25$ , $\lambda_3=0.90$ , $\lambda_{\infty}=1$ )
$\sigma_h^2$	variance of the steepness, $h$
$\sigma_d^2$	variance of recruitment deviations, $d^R$

### Parameters (derived)

$\alpha, \beta, h$	parameters of the stock recruitment relationship
$a_{50}$	age at 50% vulnerability to the fishing gear
$d_t^M$	mortality deviations in year $t$
$d_t^R$	recruitment deviations in year $t$
$d^{GN}$	deviations in gillnet selectivity
$\varepsilon^{process}$	process error in number of ageing samples, $N_{t,p}^X$
$F_{t,a}'$	fishing mortality rate for fish of age $a$ in year $t$
$\kappa$	initial fishing mortality rate for $t < t'$
$q_1$	spawn index proportionality constant for $t \leq T'$
$\psi$	average natural mortality rate in year $t = t'$
$\sigma_{a_{50}}$	standard deviation in $a_{50}$

### State Variables

$B_t$	biomass in year $t$
$B_t^S$	spawning stock biomass in year $t$
$\hat{C}_{t,p,a}$	model estimated catch-at-age $a$ by period $p$ and year $t$
$F_{t,p}$	instantaneous fishing mortality by period $p$ and year $t$
$M_t$	instantaneous natural mortality in year $t$
$\bar{M}$	average natural mortality rate
$N_{t,a}$	number of fish of age $a$ at the beginning of year $t$
$N_{t,p,a}$	number of fish of age $a$ at the beginning of period $p$ of year $t$ that are available to the fishery
$\hat{P}_{t,p,a}$	model estimated proportion of fish at age $a$ in period $p$ of year $t$
$R_0$	unfished recruitment
$R_t$	recruitment in year $t$
$s_{t,p,a}$	selectivity to the fishery at age $a$ in period $p$ of year $t$

### B.1. Model initialization

Model initialization assumes equilibrium conditions with a constant level of fishing ( $\kappa$ ) in years prior to the first year of the analysis ( $t < t'$ , pre-1951). To initialize the age structure of the model, we must first calculate the relative proportion of fish in each of the age groups ( $a = k$  to  $K-1$ ) for years  $t = t' - n$  (subtracting one year for each age group). This means the model is initialized to  $t = 1942$ . Equations used to initialize the population are laid out in Table 4 and Table 5.

Table 4. Population initialization

$N_{t'-n-1,a} = R_0 \times \tilde{N}_a$	( T4.1 )
$\tilde{N}_{a=k} = \exp(-M_{a=k})$	( T4.2 )
$\tilde{N}_{a>k} = \tilde{N}_{a-1} \times \exp(-M_a)$	( T4.3 )
$\tilde{N}_{a>k} = \tilde{N}_{a=k} / (1 - \exp(-M_{a>k}))$	( T4.4 )
$B_{t'-n-1}^S = \sum N_{t,a} w'_{t,a} \lambda_a$	( T4.5 )
$N_{t+1,a} = N_{t,a} \lambda_a \exp(-M_{t,a} - F_t) + N_{t,a} (1 - \lambda_a) \exp(-M_{t,a})$	( T4.6 )
$B_{t>t',a} = \sum N_{t,a} \lambda_{t,a} w_{t,a}$	( T4.7 )

In the year prior to population initialization,  $t = t' - n - 1$ , numbers at age,  $N_{t'-n-1,a}$  (T4.1), are calculated by multiplying the relative proportion of fish in each age group,  $\tilde{N}_a$  (T4.2–T4.4), by the unfished recruitment,  $R_0$  (Table 5). From here, we set  $N_{t'-n,a} = N_{t'-n-1,a}$  and derive numbers at age for years  $t' - n$  to  $t'$  by calculating the spawning biomass,  $B_{t,a}^S$  (T4.5), and subsequent recruits,  $R_t$  (T5.1). We then add new recruits,  $R_t$ , to numbers at age,  $N_{t-1}$ , in the previous year. Natural mortality ( $M_t$ ), availability ( $\lambda_a$ ), and weight-at-age ( $w_{t,a}$ ) for this initialization step are equivalent to those values used in  $t'$ , i.e.  $M_{t,t'} = M_{t'}$ . In the final steps (T4.6–T4.7), we subtract from the initial population the effects of natural mortality,  $M_t$ , and initial fishing mortality,  $\kappa$ , and then calculate the corresponding biomass,  $B_t$ .

Table 5. Stock-recruitment relationship

$R_{t,a} = \frac{\alpha B_t}{\beta + B_t} \exp(d_t^R - 0.5\sigma_R^2)$	( T5.1 )
$\alpha = R_0 \frac{4h}{(5h-1)}$	( T5.2 )

$$\beta = B_0 \frac{(1-h)}{(5h-1)} \quad (\text{T5.3})$$

$$B_0 = R_0 \left( \sum_{a=1}^A \left( \lambda_a w'_{t,a} \exp \left( \sum_{a=1}^t -M'_{t,a} \right) \right) + \lambda_A w'_{t,a=A} \exp \left( \sum_{a=1}^A -M'_{t,a} \right) (1 - \exp(-M'_{t,a=A}))^{-1} \right) \quad (\text{T5.4})$$

Model initialization also includes calculation of fishery selectivity,  $s_{t,p,a}$ , and natural mortality,  $M_t$ . Selectivity is modelled for each fishing period using variations of the logistic equation (T6.1 and T6.2). Time-varying natural mortality (T6.3 and T6.4) is apportioned across fishing periods as a fraction of annual mortality (T6.5 and T6.6), with annual deviations,  $d_t^M$ , modelled using a random walk. The 2006 implementation of the HCAM model included estimation of annual availability/ maturity,  $\lambda_a$ , however, in the 2008 and 2009 assessments a fixed availability schedule is used. Average natural mortality rate,  $\bar{M}$ , is also calculated (T6.7).

Table 6. Fishery selectivity and natural mortality

$$s_{t,p \leq 2,a} = 1 / (1 + \exp(-\sigma_{a_{50}} (t - a_{50}))) \quad (\text{T6.1})$$

$$s_{t,p=3,a} = 1 / (1 + \exp(a_{50} - \sigma_{a_{50}} w'_{t,a} \exp(0.2 d_t^{GN}))) \quad (\text{T6.2})$$

$$M_{t+1} = \psi \quad (\text{T6.3})$$

$$M_{t+1} = \exp(d_t^M) M_{t-1} \quad (\text{T6.4})$$

$$M_{t,p=1} = 0.90 M_t \quad (\text{T6.5})$$

$$M_{t,p=2} = 0.05 M_t \quad (\text{T6.6})$$

$$\bar{M} = \sum_{t=1}^T M_t / ((T - t' + 1)(K - k + 1)) \quad (\text{T6.7})$$

## B.2. Population and fishing dynamics

After the model initialization step, the model estimates these variables: available numbers at age  $N'_{t,a}$  and total numbers at age  $N_{t,a}$ , both estimated by year and period (T7.1–T7.5), estimated spawning biomass, (T7.6), catch,  $\hat{C}_{t,p,a}$ , and age composition,  $\hat{P}_{t,p,a}$ . Catch is predicted using the discrete catch equation (T7.7) and is assumed to be known with great certainty, thus differences between observed and predicted catch are assumed to follow a log normal distribution with a mean of 0 and standard deviation of 0.005. In this calculation, fishing mortality,  $F'_{t,a}$  (T7.8), is estimated as a free parameter.

Fitted proportions at age,  $\hat{P}_{t,p,a}$ , are estimated using predicted catch (T7.9). This implementation of the HCAMv2 assumes no ageing error.

Table 7. Population and fishing dynamics

$N'_{t,p=1,a} = \lambda_a N_{t,a}$	( T7.1 )
$N'_{t,p>1,a} = \exp(-M_{t,p} - F_{t,p}) N'_{t,p,a}$	( T7.2 )
$N_{t+1,a+1} = N'_{t,p=p'+1,a} + (1 - \lambda_a) \exp(-M_t) N_{t,a}$	( T7.3 )
$N_{t+1,a+1} = N'_{t,p=p'+1,a} + (1 - \lambda_a) \exp(-M_t) N_{t,a} + N'_{t,p=p'+1,a=K} + (1 - \lambda_{a=K}) \exp(-M_t) N_{t,a=K}$	( T7.4 )
$N_{t,a=K} = R_t$	( T7.5 )
$B_t^S = \sum_{a=k}^K N'_{t,p=p'+1,a} w_{t,a} \lambda_a$	( T7.6 )
$\hat{C}_{t,p,a} = \exp(-M_{t,p}) s_{t,p,a} F'_{t,p} N'_{t,p,a}$	( T7.7 )
$F_{t,p,a} = -\ln(s_{t,p,a} F'_{t,p})$	( T7.8 )
$\hat{P}_{t,p,a} = \hat{C}_{t,p,a} / \sum_{a=k}^K \hat{C}_{t,p,a}$	( T7.9 )

### B.3. Likelihoods

The final component of the estimation procedure is the objective function. Table 8 summarizes the likelihoods components and Table 9 the associated priors related to: 1) age composition with process error, 2) commercial catch and 3) the spawn index.

Table 8. Negative log likelihoods

<i>Age composition data</i>	
$-\ln(L) = N_{t,p}^S \ln(\hat{P}_{t,p,a}) - N_{t,p}^S \ln(P_{t,p,a})$	( T8.1 )
$-\ln(L) = 0.5 \sum_{t,p,a} \ln(r_{t,p,a}) - \sum_{t,p,a} \ln \left[ \exp \left[ \frac{-(P_{t,p,a} - \hat{P}_{t,p,a})^2}{2r_{t,p,a} / N_{t,p}^S} \right] + 0.01 \right]$	( T8.2 )
where $r_{t,p,a} = (1 - P_{t,p,a}) P_{t,p,a} + (0.01 / (T - t' + 1))$	( T8.3 )
$N_{t,p}^S = \frac{1}{1 / \tilde{N}_{t,p}^S + 1 / \epsilon^{process}}$	( T8.4 )

$$\begin{array}{c} \text{Catch} \\ -\ln(L) = \frac{\sum_{t=t'}^T \ln \left( C_{t,p,a} / \hat{C}_{t,p,a} \right)}{2\sigma_C^2} \end{array} \quad (\text{T8.5})$$

$$\begin{array}{c} \text{Spawn index data} \\ -\ln(L) = \frac{\sum_{t=t'}^T \ln \left( I_t / qB_t \right)}{2\sigma_I^2} \end{array} \quad (\text{T8.6})$$

Table 9. Prior contributions to the objective function

$$\begin{array}{c} \text{Average natural mortality rate} \\ \frac{(\bar{M} - 0.45)}{2\sigma_{\bar{M}}^2} \end{array} \quad (\text{T9.1})$$

$$\begin{array}{c} \text{Deviations in average natural mortality rate} \\ \frac{d_t^M}{2\sigma_M^2} \end{array} \quad (\text{T9.2})$$

$$\begin{array}{c} \text{Recruitment deviations} \\ (T - t') \ln(\sigma_R) + \sum_{t=t'+1}^T \left[ \frac{(d_t^R)^2}{2\sigma_R^2} \right] \end{array} \quad (\text{T9.3})$$

$$\begin{array}{c} \text{Steepness} \\ \frac{(h - 0.5)}{2\sigma_h^2} \end{array} \quad (\text{T9.4})$$

$$\begin{array}{c} \text{Initial fishing mortality} \\ \ln(\kappa) - \frac{0.5(\ln(\kappa) - \ln(0.3166))^2}{(0.6633)^2} \end{array} \quad (\text{T9.5})$$

